Operating instruction

Number of instruction:
LMI-16-05/03/09/ENG

Analytical balances
AS series

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1. TECHNICAL DATA

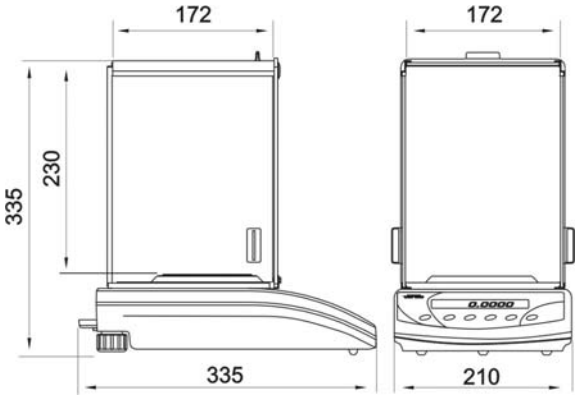
AS series balances:

Type	**AS 60/C/2**	**AS 60/220/C/2**	**AS 110/C/2**	**AS 160/C/2**	**AS 220/C/2**	**AS 310/C/2***
Maximum capacity	60g	60/220g	110g	160g	220g	310g
Minimal load	1mg	1mg	10 mg	10 mg	10 mg	10 mg
Readability	0,01mg	0,01/0,1mg	0,1 mg	0,1mg	0,1mg	0,1mg
Tare range	-60g	-220g	-110 g	-160 g	-220 g	-310 g
Repeatability	0,02mg	0,02/0,1mg	0,1 mg	0,15 mg	0,15 mg	0,2 mg
Linearity	±0,05mg	±0,05/0,2mg	± 0,3 mg			
Pan size	Φ 70 mm		Φ 85 mm			
Sensitivity drift	2 ppm/°C in temperature +15 ° - +35 °C					
Working temperature	+10 ° - +45 °C					
Power supply	230V 50Hz AC / 11V AC					
Calibration	Internal (automatic)					
Display	LCD with backlight					

*** balance not verified**

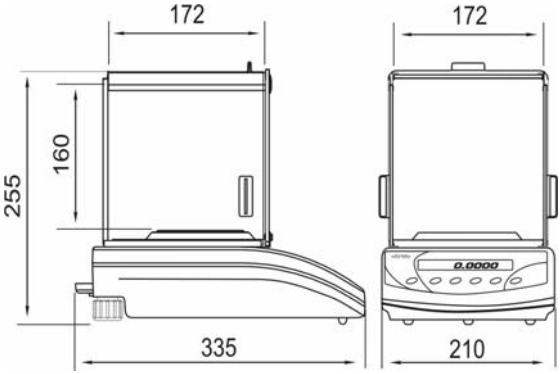
Type	**AS 140/C/1/CT AS 140/C/2/CT**	**AS 240/C/1/CT AS 240/C/2/CT**	**AS 320/C/1/CT AS 320/C/2/CT**
Maximum capacity	140g/700ct	240g/1200ct	320g/1600ct
Minimal load	0,004g/0,02ct	0,004g/0,02ct	0,004g/0,02ct
Readability	0,0002/0,001ct	0,0002g/0,001ct	0,0002g/0,001ct
Tare range	-140g/-700ct	-240g/-1200ct	-320g/-1600ct
Repeatability	0,0002g/0,001ct		0,0004g/0,002ct
Linearity	±0,0002g/0,001ct		±0,0004g/0,002ct
Pan size	Φ 85 mm		
Sensitivity drift	2 ppm/°C in temperature +15 ° - +35 °C		
Working temperature	+15 ° - +30 °C		
Power supply	230V 50Hz AC / 11V AC		
Calibration	internal (for C/2) or external (for C/1)		
Display	LCD with backlight		

Dimensions of balance:



AS series:

AS 60/C/2
AS 60/220/C/2
AS 110/C/2
AS 160/C/2
AS 220/C/2
AS 310/C/2



AS series:

AS 140/C/1/CT
AS 140/C/2/CT
AS 240/C/1/CT
AS 240/C/2/CT
AS 320/C/1/CT
AS 320/C/2/CT

2. BASIC INFORMATION

2.1. Intended use

Balance you have acquired serves to determine the weighing value of a load in laboratory environment. It is intended for application as a non-automatic weighing instrument only, i.e. the material to be weighed is manually and carefully placed in the center of the weighing pan. Weighing result should be read only after stable reading has been obtained.

2.2. Inappropriate use

Do not use the balance as a dynamic weighing instrument. Even if small quantities of weighed material are added or removed from the weighing pan of the instrument, the reading should be taken only after stabilization of the result. Do not place any magnetic materials on the weighing pan, as this can cause damage of the measuring system of the instrument.. Be sure to avoid impact shock and overloading the balance in excess of the prescribed maximum load rating, minus any possible tare weight that has been applied. Never use the balance in an environment endangered by an explosion. This balance has not been adjusted for operation in explosive areas. There must not be any modification made to the balance.

2.3. Warranty

Warranty is not valid at the following:

- Non-observation of the guidelines in the user manual,
- Use of balance other than specified in this manual,
- Alternation to or opening of the device,
- Mechanical damage and damage caused by media, natural water, and tear,
- Inappropriate erection or electric installation,
- Overloading of the measuring instrument.

2.4. Monitoring the metrological parameters of the instrument

Metrological features of the balance should be tested by the user within regular intervals of time, within scope of quality assurance.

2.5. Data included in this user manual

Please read the user manual carefully before erecting and commissioning, even if the user has is experienced with this kind of weighing instruments.

2.6. Staff training

This balance may only be operated and looked after by trained member of staff.

3. TRANSPORT AND STORAGE

3.1. Acceptance check

Please check the packaging immediately upon delivery and the device during unpacking for any visible signs of external damage.

3.2. Packaging

Please retain all parts of the original packaging in case it should be necessary to transport or return items at any time. Only the original packaging should be used for return consignments. Before dispatch, disconnect all attached cables and loose/movable parts (weighing pan, protecting shields, etc). Please place any elements of the balance in its original packing. Please protect the balance and its parts against any damage while in transport.

4. UNPACKING, INSTALLATION AND COMMISSONING

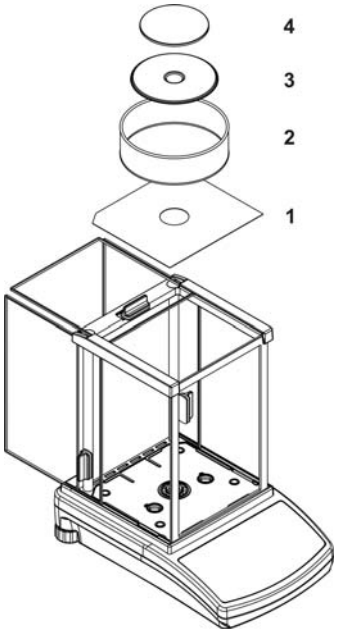
4.1. Installation and operation place

* Balance should be stored and used in locations free of vibrations and shakes, free of wind and dust.
* Air temperature should not exceed range between:
  $+10^{o}C \div +45^{o}C$
* Humidity of air should not exceed 80% (not condensing).
* When operating the balance, room temperature should not change more than $0,5^{o}C$ within one hour,
* The balance should be placed on a stable surface not affected by vibrations and distant from heat sources.
* Please take special safety measures when weighing magnetic loads, as part of this balance is a strong magnet. If there is a necessity to perform measurement of such load, please use option of under hook weighing, which removes the load from area influenced by the magnet. For installation place of under hook device, please look at the bottom casing of the balance,.
* Avoid static charging of items to be weighed, or weighing container. In case of static discharges may occur, please ground the device. Grounding bolt is placed At the back side of the balance's casing.

4.2. Unpacking

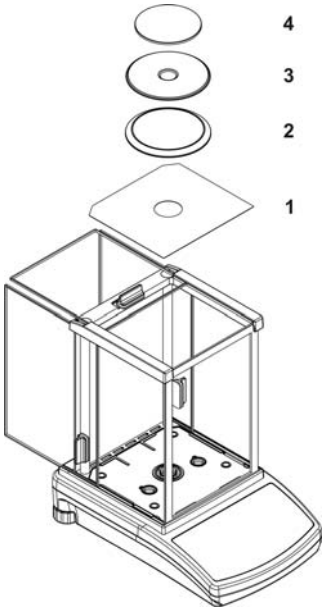
Carefully remove the balance from its packaging, remove the plastic and foil wrapping and gently. Install the weighing pan, and other elements according to below schema:

The balance with Φ 70 mm pan:



- open side doors of weighing chamber,
- inside the chamber place lower shield of weighing chamber (1),
- put anti-breeze shield (2) on the lower shield,
- put centering ring (3) on the lower shield,
- put the balance pan (4) inside the ring,
- close side doors of weighing chamber,
- turn on balance supply,
- pin of power adaptor should be connected to socket in the back of balance casing.

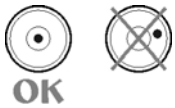
The balance with Φ 85 mm pan:



- open side doors of weighing chamber,
- inside the chamber place lower shield of weighing chamber (1),
- inside the chamber place anti-breeze shield (2),
- put centring ring on the shield (3),
- put the balance pan inside the ring (4),
- close side doors of weighing chamber,
- turn on balance supply,
- pin of power adaptor should be connected to socket in the back of balance casing.

4.3. Positioning

Before switching on the balance, please level the device with two adjusting feet situated at the back of the casing. Please level the balance so that the air bubble of the level is placed centrally.



4.4. Standard accessories

- Balance.
- Weighing pan and protecting elements.
- Power adapter.
- User manual.

4.5. Cleaning

Balance should be cleaned with damp cloth. In order to clean the weighing pan of the balance, please remove it from the weighing chamber. Cleaning of the pan when installed may cause damage of the measuring system of the balance.

4.6. Connection to mains

Balance can be connected to mains only with a power adapter offered as standard accessory to the balance. Nominal power supply of the power adapter (specified on the data plate of the power adapter) should be compatible to the power from mains. Please plug the adapter the socket at the back of the balance, the display with light on and show sequence of digits – display test), after which balance will display 0.0000g. if indication is different from zero, please press **ESC/TARA button**.

4.7. Connection of additional equipment

The balance must be disconnected from the mains before connecting or disconnecting additional equipment (printer, PC) to or from the data interface. Use only accessories and peripheral equipment recommended by the manufacturer with your balance. These have been ideally coordinated to your balance.

5. BASIC FUNCTIONS OF THE INSTRUMENT

Electronic balance is appropriate for precise measurements mass in laboratory conditions with possibility of setting to zero in all measure range. Balance calibration is done by **F** on balance keyboard.

✓ **Functions for weighing units (press Units key)**
- select default units of weighing **<StUn>**,
- Weighing in grams,
- Weighing in [mg],
- Weighing in [ct],
- Weighing in units from beyond **SI** (only: [oz], [ozt], [dwt], [t], [mom], [gn], Access to these units is blocked from factory menu level,

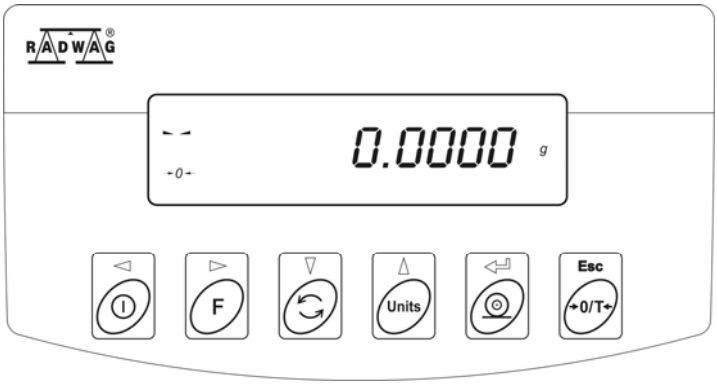
- ✓ **Functions for calibration and weighing modes**
  - Counting pieces **< PIECES>**,
  - Control +/- **<HiLo>**,
  - Control of deviations % according to standard mass **<Perc A>, <Perc B>**,
  - Thickness of liquids **<d_Li>**or solids **<d_Co>**,
  - Pipettes calibration **<PiPEt>**.

- ✓ **Choice of criteria of stable result depending on usage conditions**
  - Turn off/on system of autozero **<AUTO>**,
  - Average result of weighing **<AvE>**,
  - Back light function**<bl>**,
  - Beep signal **<bEEP>**,

- ✓ **Function for using RS 232 (Esc/TARE key + print key)**
  - Choose speed of transmission,
  - Define sent data as: stable / not stable,
  - Continuous work,
  - automatic work for RS 232.

Moreover balance can be used to weigh hang loads, print report of calibration, check deviation of calibration and print reports of testing thickness of liquids and solids.

6. KEYBOARD



	Switches the display off. **ON/OFF** key.
	Function key. **F** key.
	Selects the work mode. **MODE** key.
	Changes measure units. **UNITS** key.
	Sends information to external instrument (PRINT) or confirms parameter value or function (ENTER). **PRINT/ENTER** Key.
	Sets indication to zero. **Esc/TARA** Key.

7. USER MENU

Menu is divided into **7** basic groups. Each group has individual name starting with capital letter **P**. Names of groups and their contents is shown below.

P1 CAL [Calibration]

P1.1	iCAL	|		[internal calibration]
P1.2	ECAL	|		[external calibration]
P1.3	tCAL	|		[temperature calibration]
P1.4	ACAL	|	both/nonE/tenno/tinnE	[automatic calibration]
P1.5	CALt	|	1 h ÷ 12h	[time of automatic calibration]
P1.6	CALr	|	YES/no	[report from calibration]

P2 GLP [Good Laboratory Practice]

P2.1	USr	|	_	[name of user]
P2.2	PrJ	|	_	[name of project]
P2.3	Ptin	|	YES/no	[printout of measurement time]
P2.4	PdAt	|	YES/no	[printout of measurement date]
P2.5	PUSr	|	YES/no	[printout of user name]
P2.6	PPrJ	|	YES/no	[printout of project name]
P2.7	PId	|	YES/no	[printout of factory number of balance]
P2.8	PFr	|	YES/no	[printout of frames]

P3 rEAd [Main user parameters]

P3.1	AuE	|	Stand/Slouu/FASt	[filtering level]
P3.2	ConF	|	FASt_rEL/Fast/rEL	[confirmation of result]
P3.3	Auto	|	On/OFF	[autozero]
P3.4	Ldi9	|	ALuuAYS/neper/uu_StAb	[light off the last digit]

P4 Print [Data transmission – RS 232]

P4.1	bAud	|	2400/4800/9600/19200	[speed of transmission]
P4.2	CntA	|	YES/no	[continuous printout in basic unit]
P4.3	Cntb	|	YES/no	[continuous printout in currently used unit]
P4.4	rEPL	|	YES/no	[manual or automatic operating]
P4.5	PStb	|	YES/no	[result printout: stable or unstable]
P4.6	Lo	|	000.0000	[min mass for automatic operating]
P4.7	P_PC	|	YES/no	[printout destination: printer / PC computer]

P5 Unit [Mass units]

P5.1	StUn	g/mg/ct/oz/ozt/dwt/t/mom/G		[basic mass unit – e.g. gram]
P5.2	mg	YES/no		[mg - milligram]
P5.3	Ct	YES/no		[ct – carat]
P5.4	oZ	YES/no		[oz – ounce]
P5.5	oZt	YES/no		[ozt – troy ounce]
P5.6	dwt	YES/no		[dwt – pennyweight]
P5.7	t	YES/no		[t – tael]
P5.8	nno	YES/no		[mom - momme]
P5.9	Gr	YES/no		[gr – grain]

P6 Func [Functions]

P6.1	FFun	ALL/PcS/HiLo/PrcA/Prcb/d_Co/d_Li	[choice of balance function]
P6.2	PcS	YES/no	[counting pieces]
P6.3	HiLo	YES/no	[check weighing]
P6.4	PrcA	YES/no	[% deviation with reference to weighed standard mass]
P6.5	Prcb	YES/no	[% deviation with reference to declared standard mass]
P6.6	d_Co	YES/no	[density determination of solids]
P6.7	d_Li	YES/no	[density determination of liquids]

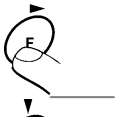
P7 othEr [Other functions]

P7.1	bL	On/Aut/OFF	[display backlight]
P7.2	bEEP	On/OFF	[keys sound]
P7.3	PrnS		[printout of balance parameters]

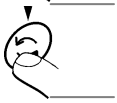
7.1. Moving in user menu

User moves in menu using balance keyboard.

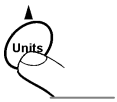
7.1.1. Balance keyboard



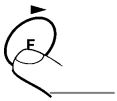
Enter to main menu. **F** key.



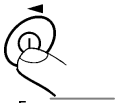
Choice of parameters group downwards the menu or change of value of a parameter by one value downwards. **MODE** key.



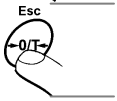
Choice of parameters group upwards the menu or change of value of parameter by one value upwards. **UNITS** key.



Choice of parameters group, which should be activated. After pressing the key, display will indicate first from parameters of chosen group. **F** key.



Exit to level higher e.g. to main menu. **On/Off** key.



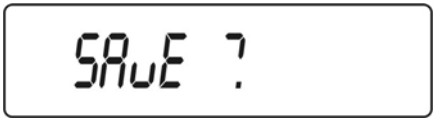
Resignation from change of parameter. **Esc/TARA** key.

Confirmation / approval introduced changes. **PRINT/ENTER** key.

7.1.2. Return to weighing function

Introduced changes in balance memory will be saved for good after return to weighing with procedure of saving changes.
Press several times **Esc** key until display indicates message **SAvE?**.

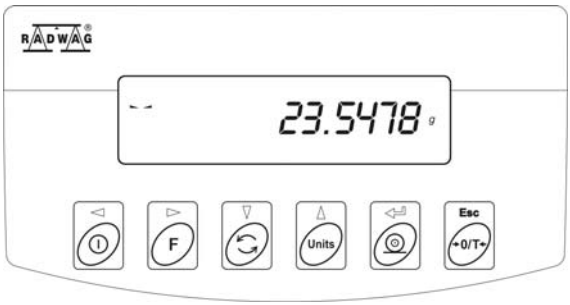
When display indicates question press if necessary: **PRINT/ENTER** – confirmation of changes or **F** – resignation from introduced changes.
After pressing appropriate key, balance will go back to weighing.



8. WEIGHING

Before weighing or if the conditions of work changes (e.g. if temperature of surrounding is higher then 0,8°C) balance should be calibrated.

- It is recommended to load the balance few times by mass close to max capacity before taking measurements,
- Check if not load balance shows „precise zero" - →0← if measurement is stable - order ◣◢, if not press key →**0/T**←,
- by means of **Units** key set measure unit : [g], [mg], [ct], and if they are accessible in factory menu [oz], [ozt], [dwt], [t], [mom], [gn],
- put load on balance and read result on display ,
- indication can be setting to zero many times by pressing key **Esc/TARE** (summary of mass loads record to balance memory cannot be bigger then its max capacity).

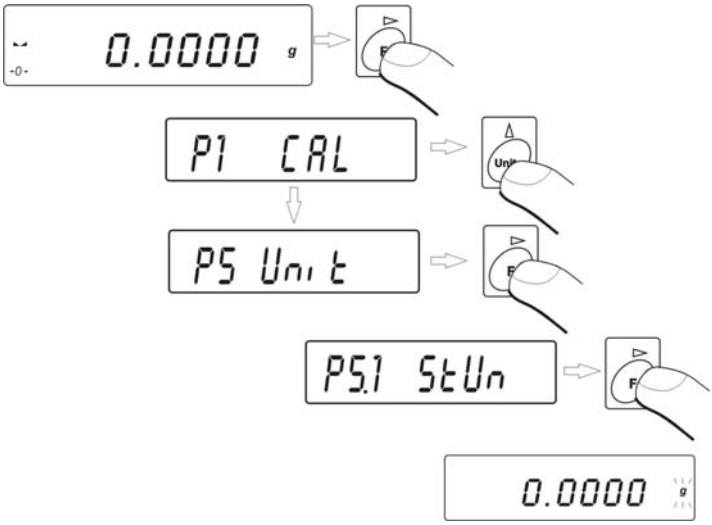


Don't unplug the balance from power supply between following measurements. Switch the balance off by pressing **ON / OFF** key. If user presses key **ON/OFF** once again balance is ready to following measurements

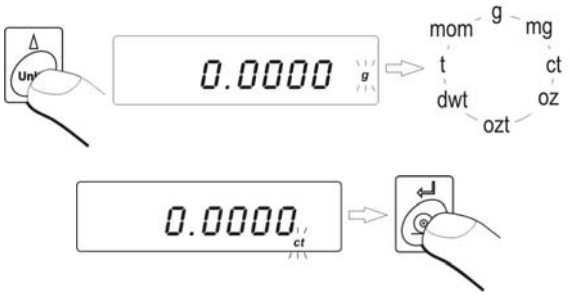
8.1. Choice of basic weighing unit

Function is used to setting the initial unit with which the balance will start after switching on.

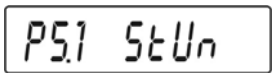
Enter to submenu **P5 Unit**,



press several times **UNITS** key. Display will indicate by turns available units.



After choosing basic unit press key. Chosen unit will stop pulsing.



Possibilities of choice:

- For EC verified balances, user can choose following units: [g], [mg], [ct]
- For non-verified balances, user can choose following units: [g], [ct], [mg], [oz], [ozt], [dwt], [t], [mom], [gn].

Go back to weighing mode with procedure of saving changes
(see point - 7.1.2. – return to weighing).

ATTENTION:
Balance after switching on will start with set basic unit.

8.2. Choice of weighing unit (temporary)

Function enables choice of unit with which mass on the pan will be indicated. Unit will be valid until change of unit or switching on and off the balance. Each pressing the **Units** key, causes change of measuring unit.

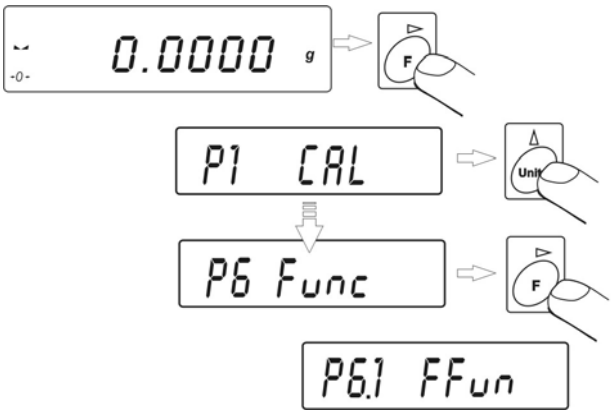
Possibilities of choice:

- For EC verified balances, user can choose following units: [g], [mg], [ct]
- For non-verified balances, user can choose following units: [g], [ct], [mg], [oz], [ozt], [dwt], [t], [mom], [gn].

8.3. Setting accessibility of balance operating modes

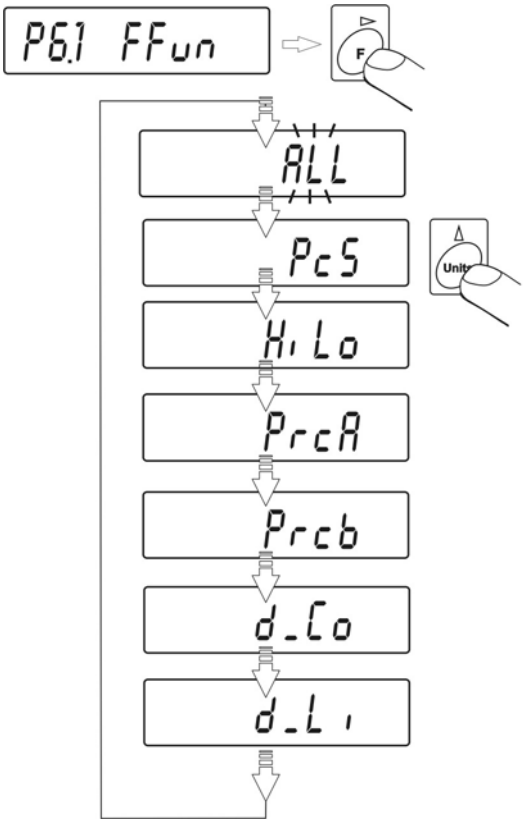
In this group of parameters user declares functions which are to be accessible for user after pressing **F** key.

Enter group **P6 Func**.

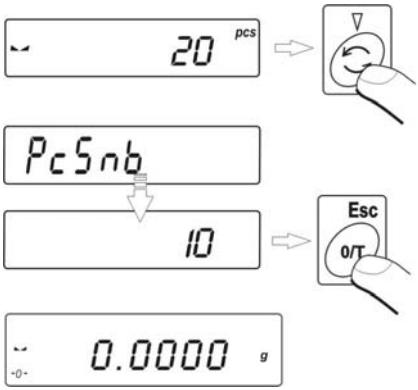


8.3.1.Choice of modes quantity accessible for user

Function enables user to set if after pressing **F** key all operating modes will be accessible (**ALL**) or only one from the list chosen and used by operator, or all functions unavailable (**OFF**).



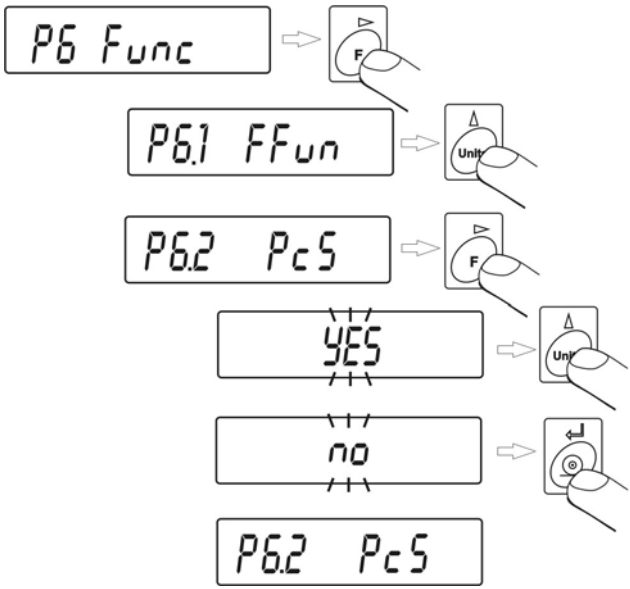
After choosing setting press **PRINT** key. Balance will go back to displaying name of submenu. **P6.1 FFun**. If function other than **ALL** is chosen, procedure of returning to weighing differs from remaining ones. If e.g. function **PcS** is chosen (procedure according to 13.1 point), to return to weighing:



Press key **Esc/TARA**, balance will return to weighing.

8.3.2. Setting contents of P6.1 FFun – ALL parameters

Function enables switching off modes not used by operator.
This causes faster access to used modes.



OFF – inaccessible mode
On – accessible mode.

Return to weighing

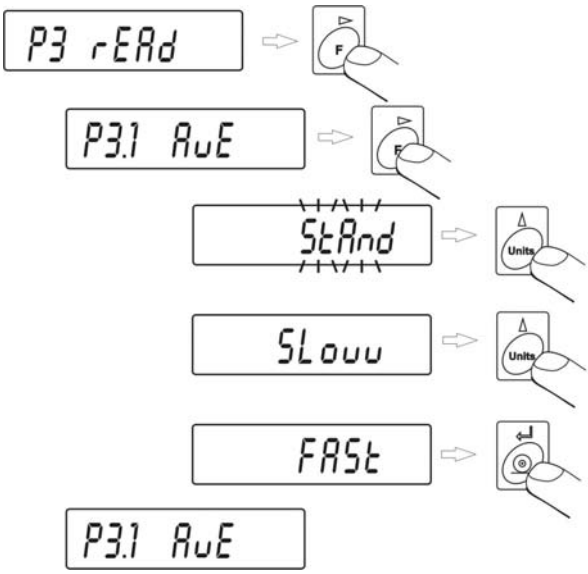
(see - 7.1.2. – return to weighing).

9. MAIN SETTING PARAMETERS

User can adjust balance to external conditions (filter range) or own needs (autozero working, memory of tare value). These parameters are in group <**P3 rEAd**>.
These functions will help user to adjust balance to external conditions in which balance operates.

9.1. Setting level of filtering

Procedure:



- using key **UNITS** choose value of filter which is needed

  1 - filtr **FASt** – (fast)
  2 - filtr **StAnd** – (standard)
  3 - filtr **Slouu** – (slow).

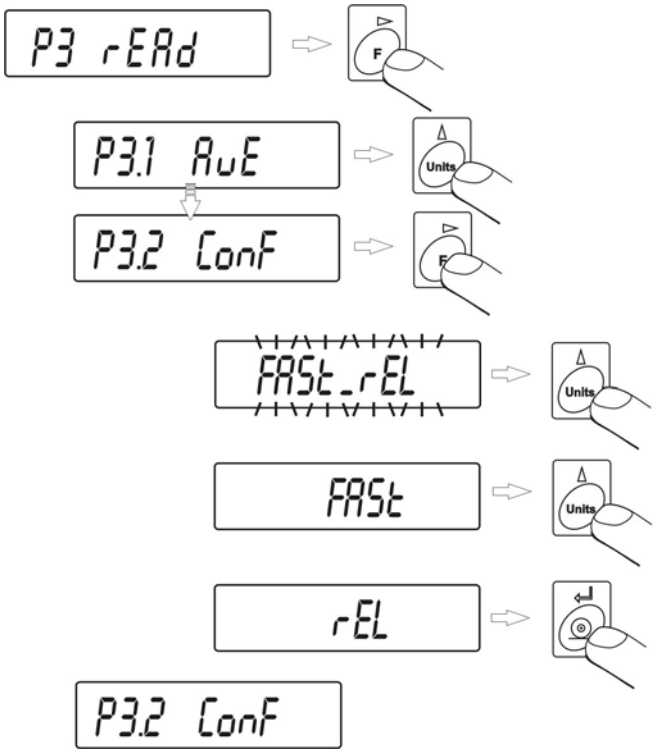
Return to weighing

(see - 7.1.2. – return to weighing).

ATTENTION:
The higher filtering level the longer time of weighing.

9.2. Result confirmation

Because of various environmental conditions it is advisable to adjust the balance by selecting method of result confirmation as: **FAST_rEL, Fast** or **rEL.** Depending on selected option, time of weighing will be shorter or longer.



Fast_rEL - fast + release
Fast - fast
rEL - release.

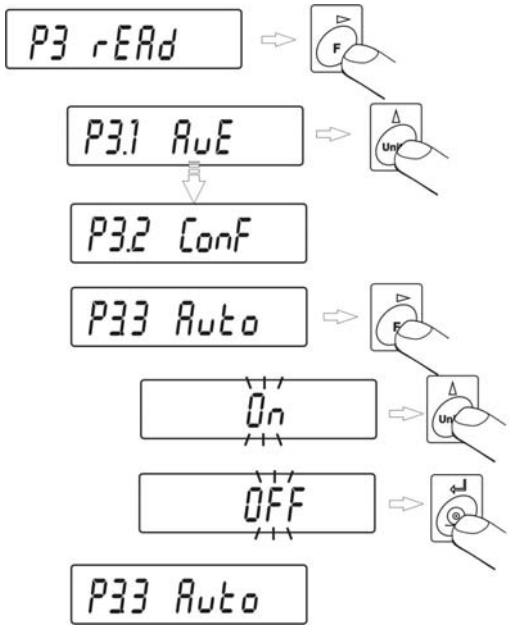
Return to weighing

(see - 7.1.2. – return to weighing).

9.3. Autozero function

In order to ensure precise indication of balance, „AUTOZERO" function was introduced. The application of this function is automatic control and correction of zero indication of balance.
When function is active comparison of results takes place at declared time intervals e.g. every 1 s, only when the pan is unloaded and results are close to zero.
If results vary by value smaller than declared AUTOZERO range e.g. one division, balance will zero automatically and stable result marker– ▂▃ and zero indication – → **0** ← will be displayed.
When AUTOZERO function is on each result starts from precise zero. However there are some cases where this function can be disturbance at measurements. Such instance is very slow placing of load on the pan (e.g. load pouring) in such case correction system of zero indication can also correct indication of real mass of load.

Procedure:

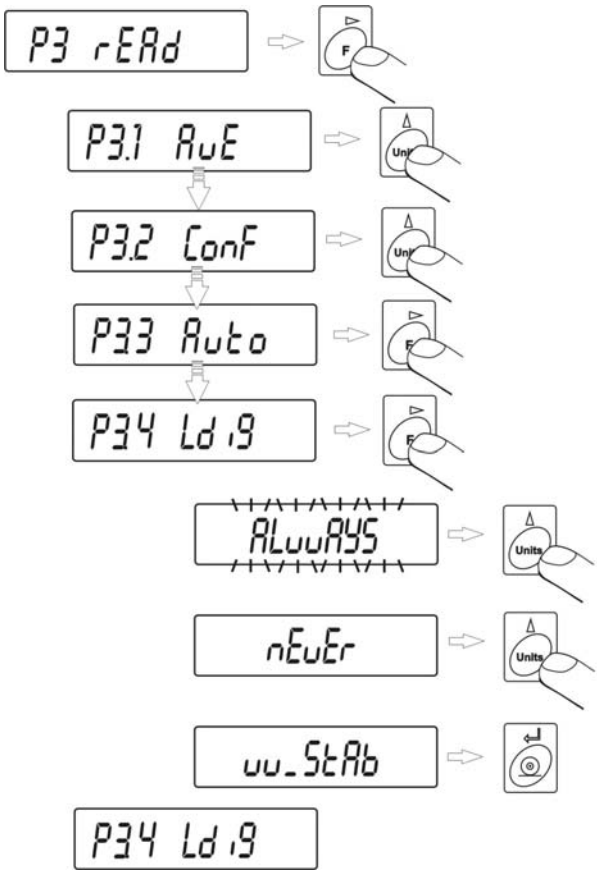


AUTOZERO **OFF** – autozero off
AUTOZERO **On** - autozero on.

Return to weighing
(see - 7.1.2. – return to weighing).

9.4. Light off the last display digit

Function enables light off the last digit on the display.



ALuuAYS - always
nEuEr - never
uu_StAb - when is stable.

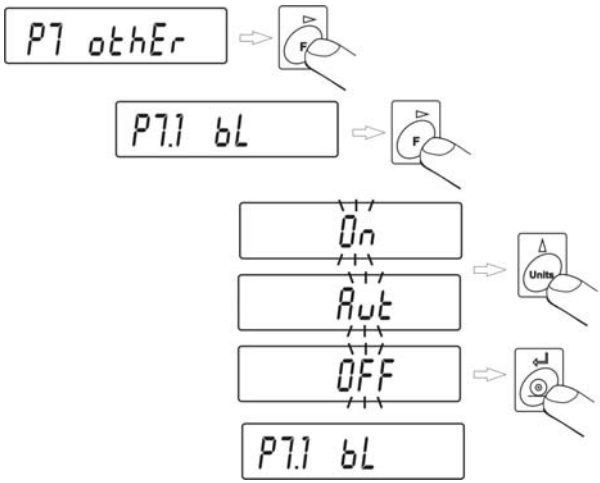
Return to weighing

(see - 7.1.2. – return to weighing).

10. ANOTHER PARAMETERS

User can set parameters which have influence on work with balance. These parameters are contained in P5 othEr e.g. backlight and „beep" signal.
Enter to P5 Others group of submenu according to point 6.1.

10.1. Backlight of weighing result

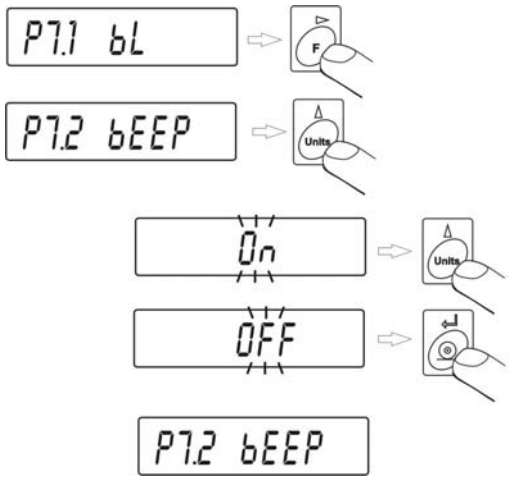


bl **OFF** – backlight off
bl **On** – backlight on
bl **Aut** – If result of weighing doesn't change for 10 seconds, backlight will turn off automatically.

Return to weighing
(see - 7.1.2. – return to weighing).

ATTENTION:
If result of weighing doesn't change for 10 seconds, backlight will turn off automatically. Backlight is turned on when indication on display changes.

10.2. “Beep” signal – reaction on pressing key

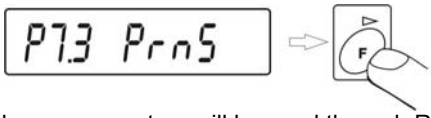


bEEP	**OFF** – signal of pressing key off
bEEP	**On** - signal of pressing key on.

Return to weighing

(see - 7.1.2. – return to weighing).

10.3. Printout of all balance parameters through RS 232 port



After pressing **F** key, balance parameters will be send through RS 232 port.

Return to weighing

(see - 7.1.2. – return to weighing).

11. BALANCE CALIBRATION

As the acceleration value due to gravity is not the same at every location on earth, each balance must be coordinated – in compliance with the underlying physical weighing principle – to the existing acceleration due to gravity at its place of location (only if the balance has not already been adjusted to the location in the factory). This adjustment process must be carried out for the location in the factory). This adjustment process must be carried out for the commissioning, after each change of location as well as in case of fluctuating environment temperature. It is also recommend to adjust the balance periodically during weighing operation in order to obtain exact measured values.
To ensure high precision of weighing corrective factor in relation to standard mass must be noted in the balance memory periodically – it is the balance calibration.

Calibration should be performed:

- Before the weighing,
- When long breaks are between following measure series
- When temperature inside the balance changes more than: 0,8° C.

Kind of calibration:

- Internal automatic calibration
  * started if temperature changes
  * started if the time changes
- Manual internal calibration
  * initiated from the balance keyboard
- Calibration made with external weight
  * with declared mass which cannot be modified.

In verified balances only automatic internal calibration and manual internal calibration is accessible.

Perform the calibration when there is no load on the pan!

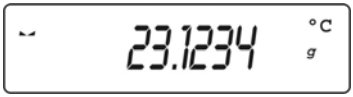
In case when there is load on the pan, display will indicate **unload**. It is comment of unloading the pan. Calibration process can be stopped if it's necessary. Press then **Esc/TARA** key.

11.1. Balance with internal calibration

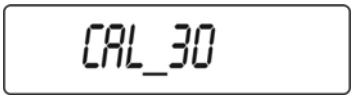
Process of calibration can be started automatically or manually.
Manual way of operation is to press three times **F** key. System of automatic calibration will automatically perform calibration informing user about successive stages.

Cycle of automatic calibration proceeds as follows:

- balance software detects necessity of calibration and signalizes it by marker of Celsius degree or by black marker



- from this moment time of 5 minutes is counted in which weighings can be performed
- when this time elapses display indicates CAL_30 message and starts count down 30..29..28 do 0 (indicated value is the counter)

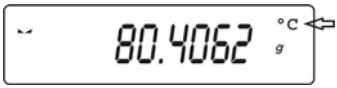


- user has 30 seconds to make a decision:
  - if calibration is to be performed, does not take any actions
  - if one wants to finish measurements presses **TARE** key, after its pressing balance returns to weighing showing previous result of weighing (possibility of finishing series of measurements) in 5 minutes balance will indicate CAL_30 message again

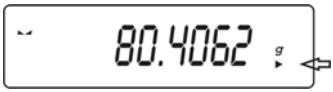
- process of calibration can be postponed frequently, but fact that long postponing of calibration can be cause of bigger error during weighing should be noticed. These errors are effect of changes of temperatures and as consequence changes of balance sensitivity.

Automatic system includes 3 possibilities:

- **calibration with regard to changes of temperature**
  balance is provided with precise system of controlling temperature changes, temperature of calibration is registered every time, next is started if temperature of surrounding changes 0,8^{o}C



- **calibration with regard to passage of time**
  user can declare 4 spaces of time that makes criterion for calibration, following option are accessible: calibration every 1 - 12 hours.



11.2. Entering calibration menu

P1	**CAL**		
P1.1	iCAL	|	
P1.2	uCAL	|	
P1.3	tCAL	|	
P1.4	ACAL	|	both
P1.5	CALt	|	1 h
P1.6	CALr	|	YES

P1.1 iCAL – Internal calibration

start of internal calibration process, process is completely automatic without interference of balance operator, if pan is loaded display will indicate message about necessity of removing the load.

P1.2 ECAL – External calibration

calibration with external weight, which value is saved in factory menu of balance, function unavailable in verified balances.

balances with internal calibration

balances with external calibration

P1.3 tCAL - Test of calibration

comparison of internal calibration mass with its value saved in balance memory.

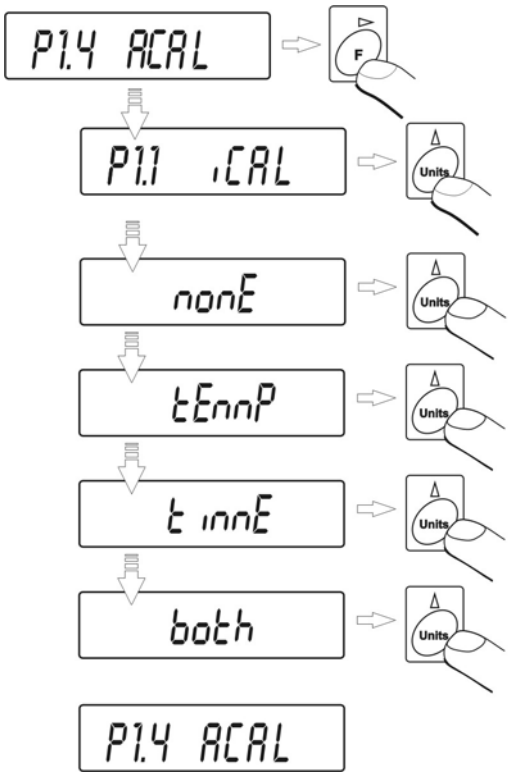
balances with internal calibration

balances with external calibration

P1.4 ACAL – Automatic calibration (balances with internal calibration)

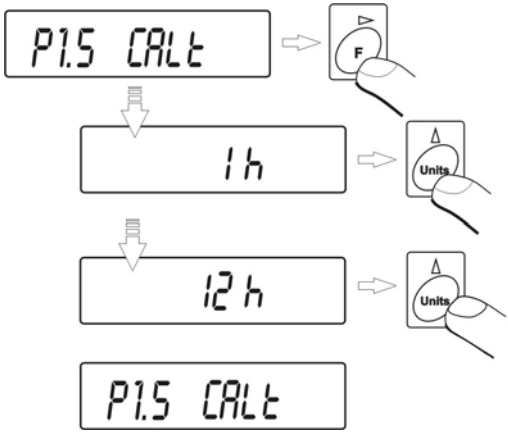
determination of factor, which should decide about starting the automatic internal calibration

nonE – none of factors will cause start of calibration
tEmP – calibration with regard to change of temperature
timE – calibration with regard to time set in P1.5 CALt
both – calibration with regard to time and temperature.



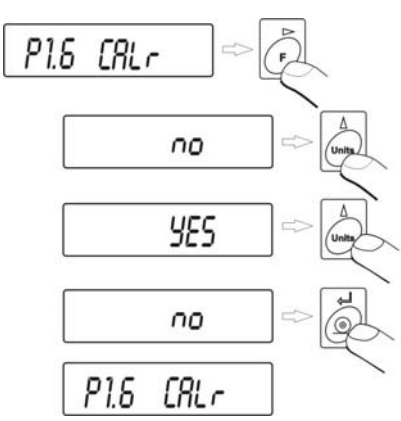
P1.5 CALt – Time of automatic calibration (balances with internal calibration)

determining the time, after which automatic calibration will start.

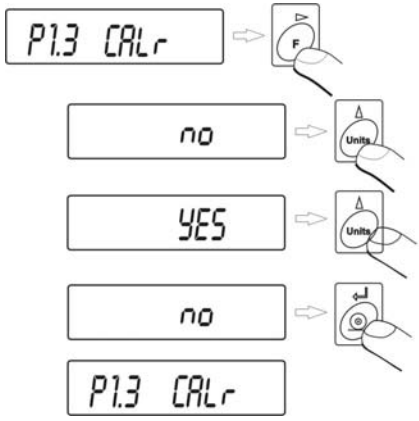


P1.6 CALr – printout from calibration report

Setting printout of report after finished calibration
no – printout of report off
YES – printout of report on.



balances with internal calibration



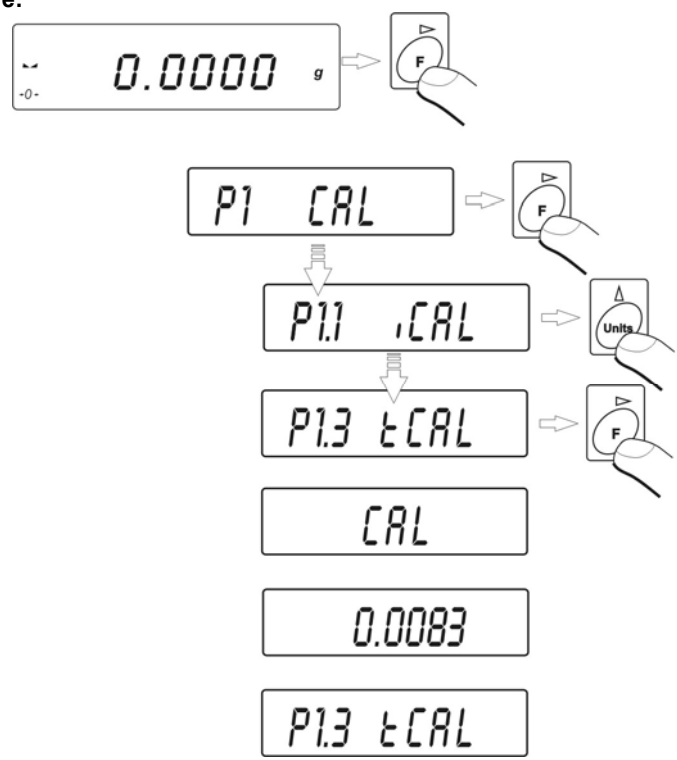
balances with external calibration

11.3. Calibration test

11.3.1. Balances with internal calibration

Internal calibration mass is compared to its value in the balance memory. This process is automatic. Its result is shown on the display. Process proceeds automatically and display indicates its result (if balance is connected to computer or to printer through RS 232 joint, printout of calibration test will take place). Press **ESC/TARA** key to return to previous screen.

Procedure:



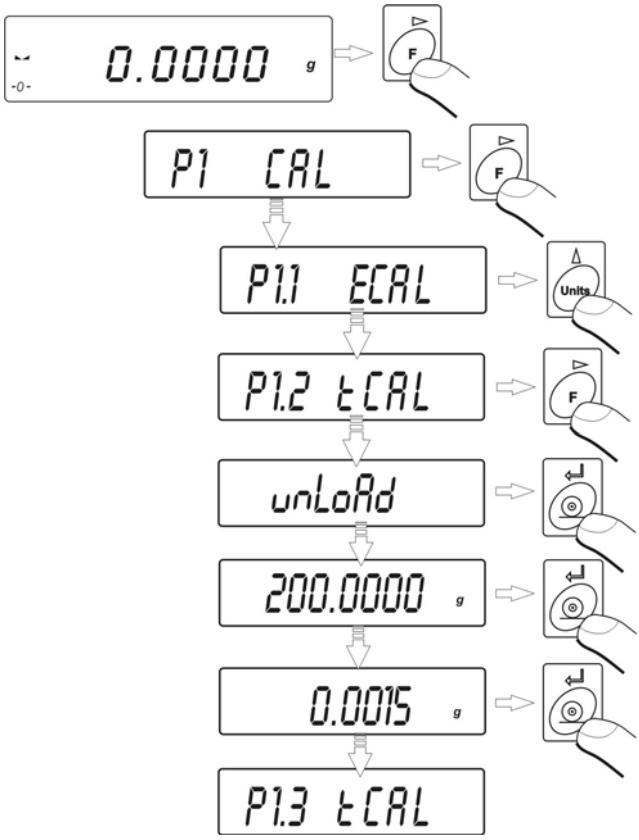
Return to weighing

The changes are recorded when the balance returns to weighing mode with the recording the changes. Press the ESC many times. Following question appears on the display.
Select one of the options : ENTER – record / ESC – cancel
(Return to weighing 7.1.2. Return to weighing).

11.3.2. Balances with external calibration

It consists in comparison of mass of standard with mass previously saved in balance memory during the calibration. Process proceeds automatically and display indicates its result (if balance is connected to computer or to printer through RS 232 joint, printout of calibration test will take place). Press **ESC/TARA** key to return to previous screen.

Procedure:



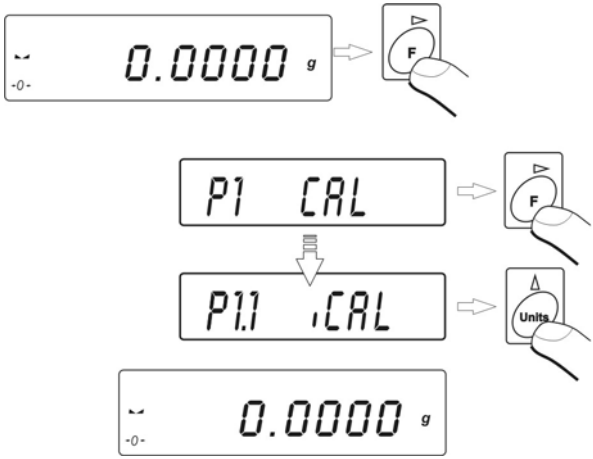
Return to weighing

(see - 7.1.2. – return to weighing).

11.4. Manual calibration

11.4.1. Internal calibration

1. Press F key three times



2. The balance performs the calibration automatically. During this calibration do not load the pan.
3. After this process the balance records results of the calibration in the memory and returns to weighing mode.

ATTENTION:

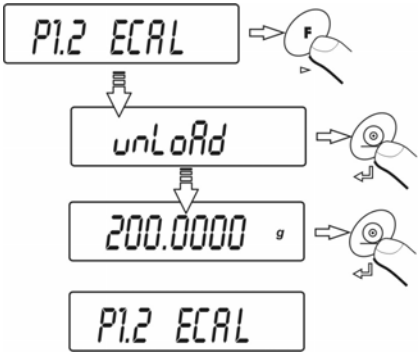
- *Pressing the ESC key stops the calibration process*
- *If during the calibration load is on the pan display show order about error. The calibration process is stopped. After take load off the calibration process is finished.*

11.4.2. External calibration

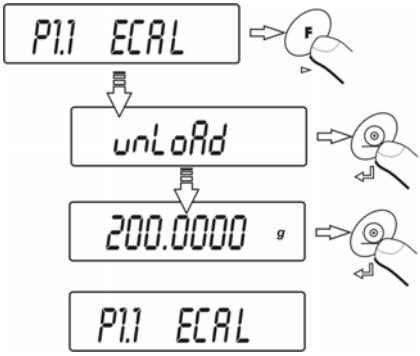
The external calibration should be performed with external mass class:

- E_2 – for balances AS

1. Start external calibration process



balances with internal calibration



balances with external calibration

2. Order to load off the pan appears on the display (no load on the pan). After yesing load off the pan press the ENTER key.
3. The balance determines mass of empty pan
4. Put load and press the ENTER
5. After the calibration the balance returns to submenu P1.2 uCAL
6. Return to weighing – as in the point 5.1.2.

If balance is verified user does not have the possibility to perform external calibration process.

11.5. Calibration report printout

After calibration user can receive the calibration report. The report can be printed on connected printer and sent to computer or recorded in file.

P1.6 CALr: **no** – report is not printed
P1.6 CALr: **YES** – report is printed

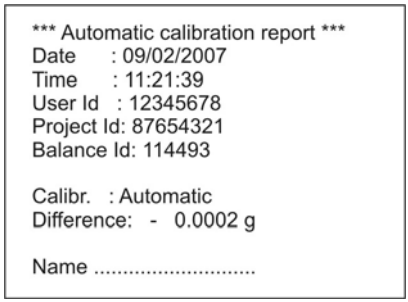
If the parameter has the value YES, the report is generated and sent automatically.

A content of report depends on setting in submenu GLP. All options with YES attribute are printed.

P2 GLP

P2.1	uSr	|	
P2.2	PrJ	|	
P2.3	Ptin	|	YES
P2.4	PdAt	|	YES
P2.5	PuS	|	YES
P2.6	PPrJ	|	YES
P2.7	PId	|	YES
P2.8	PFrn	|	YES

Apart from information settled in menu group the report contains: difference between calibration mass remembered by balance after last calibration and calibration mass determined during actual calibration and other information.



12. SETTING PRINTOUTS FOR GLP PROCEDURES

P2 GLP is group of the parameters which declares factors on the calibration printout.

P2 GLP

P2.1	uSr	|	
P2.2	PrJ	|	
P2.3	Ptin	|	YES
P2.4	PdAt	|	YES
P2.5	PuS	|	YES
P2.6	PPrJ	|	YES
P2.7	PId	|	YES
P2.8	PFrn	|	YES

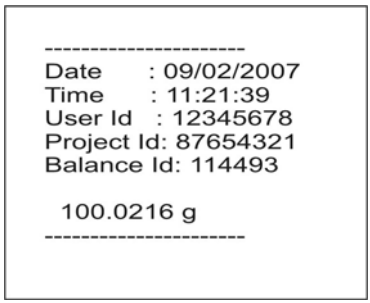
For fields:

- user (max 8 alphanumerical signs)
- design (max 8 alphanumerical signs)

introduce names by the balance keyboard.

For the rest select:

- no (do not print during report)
- yes (print during report)



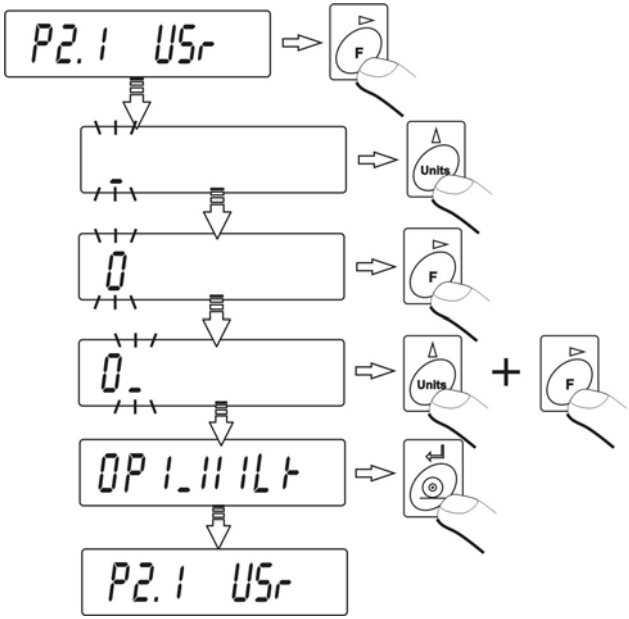
12.1. Setting the contents of printouts for GLP procedures

P2 GLP group of parameters enabling to declare variables, which will appear on calibration printout and printout from measurement.

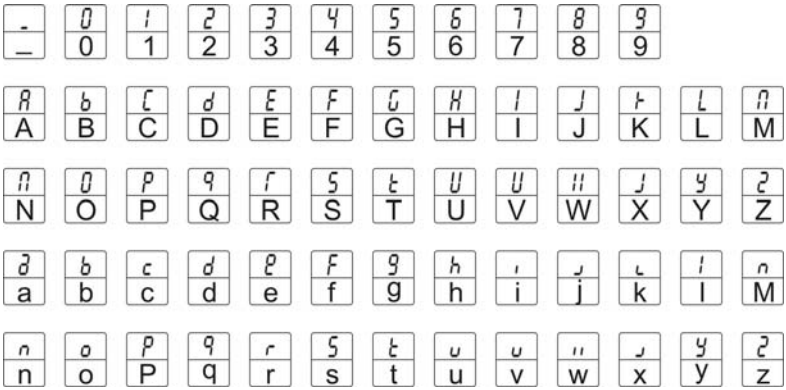
P2	**GLP**		
P2.1	USr	|	
P2.2	PrJ	|	
P2.3	Ptin	|	YES
P2.4	PdAt	|	YES
P2.5	PUSr	|	YES
P2.6	PPrJ	|	YES
P2.7	PId	|	YES
P2.8	PFr	|	YES

- **P2.1 USr**

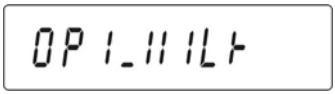
Option enabling to introduce name of user who operates the scale. User has possibility to introduce the name consisting of max 8 alphanumeric characters. Introduction the name is possible by the means of scale keyboard with **F**, **MODE**, **UNITS** and **PRINT** keys.



Available characters and their equivalents displayed by scale are shown on the drawing below:

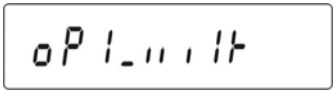


Exemplary user name introduced to scale with capital letters:



OP1_WILK (operator 1 WILK)

Exemplary user name introduced to scale with small letters:



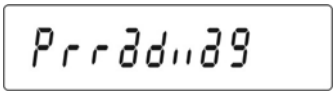
op1_wilk (operator 1 wilk)

- **P2.2 PrJ**

Option enabling to introduce the Project name (e.g. associated with specific weighing type).
Exemplary project name introduced to scale with capital letters:

PRRADWAG

Exemplary project name introduced to scale with small letters:



prradwag

- **P2.3 Ptin**

Option enabling to print time of performed measurement.

- **P2.4 PdAt**

Option enabling to print data of performed measurement.

- **P2.5 PUSr**

Option enabling to print user name.

- **P2.6 PPrJ**

Option enabling to print project name.

- **P2.7 PId**

Option enabling to print factory number of scale.

- **P2.8 PFr**

Option enabling to print frames on printout.

Parameters described above, choose the values:

no	**-** not to print during report
YES	**-** to print during report.

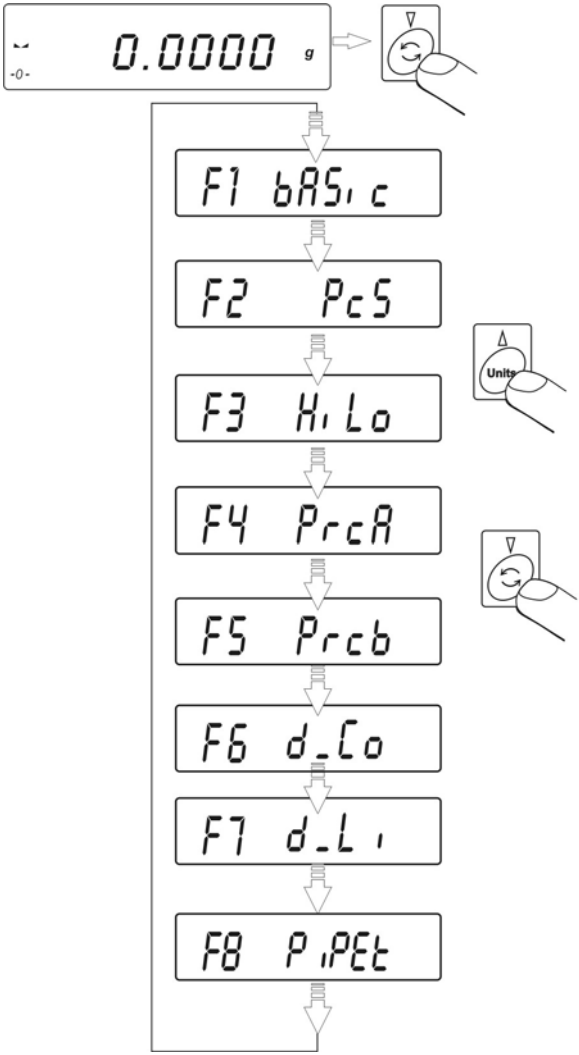
Return to weighing

(see - 7.1.2. – return to weighing).

13. BALANCE OPERATING MODES

- Counting pieces
- +/- control referring mass of set standard
- Control of % deviation referring mass of standard
- Definition thickness of solids and liquids.

Press **MODE** key:



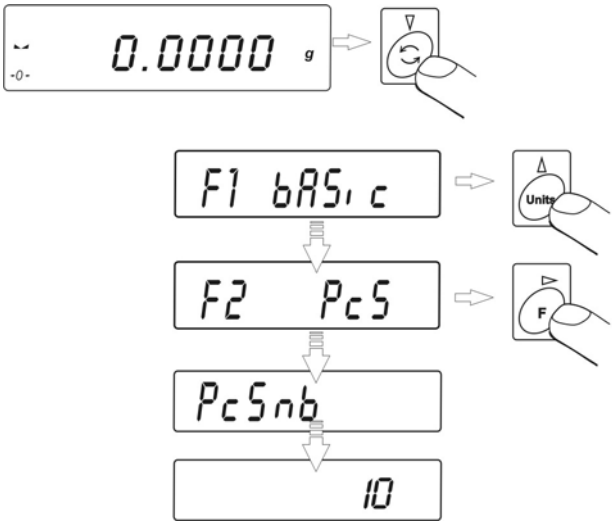
After pressing **MODE** key , name of first available function will be indicated. Each next pressing **UNITS** or **MODE** key causes displaying name of next available functions, way of setting the functions is described in further part of this manual.

13.1. Counting details of the same mass

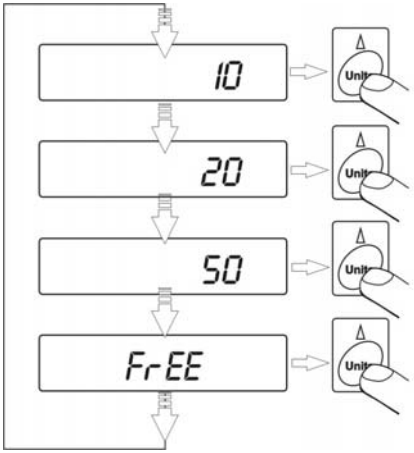
Balance in standard execution is equipped with option of counting small pieces of the same mass. Counting pieces doesn't operate with other balance functions.

To use this option:

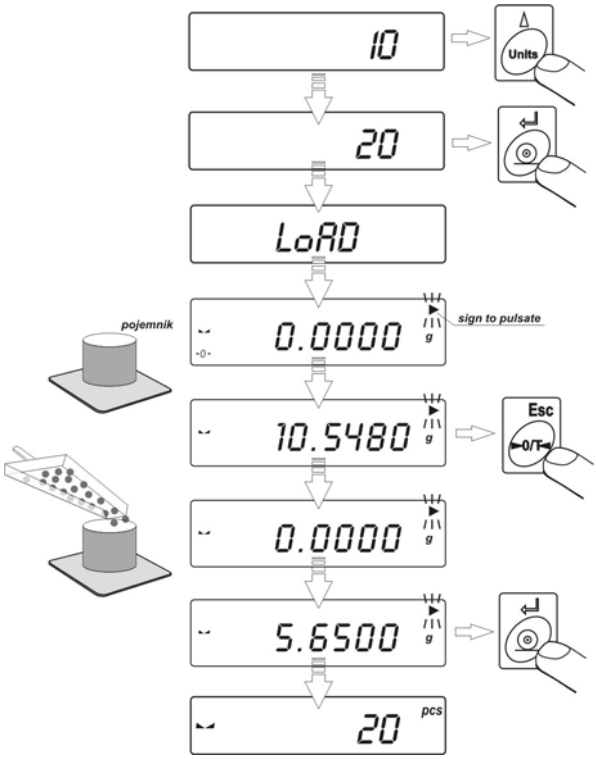
- enter to PIECE function.



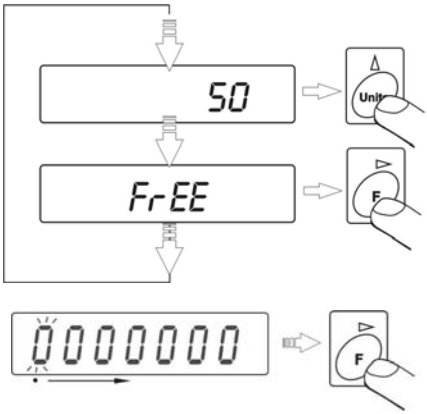
- press **UNITS** key to start setting quantity of sample, you have at choice few options



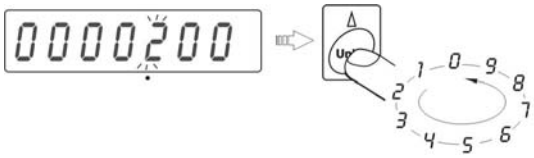
- pressing **UNITS** key to choose of value (10, 20, 50pcs or free)
- if you want to choose one them e.g. 20pcs press **PRINT** and proceed as shown on picture



- If option **FrEE** was chosen, you must enter quantity of sample, which will serve to determine mass of single detail



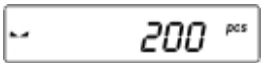
- Pressing **F** key chooses digit which will be changed



- Pressing **UNITS** changes value of digit

  - Confirm entered value by pressing **PRINT** key
  - Display will indicate **LoAd** message – place on the pan as many details as entered during option

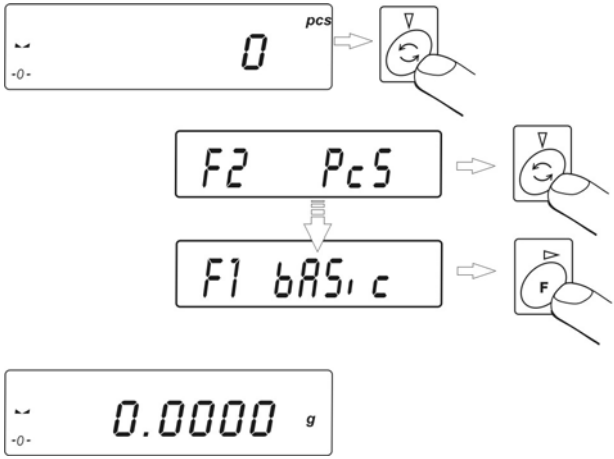
  - Press **PRINT** key – balance will indicate quantity of sample (PCS symbol is active)



  - add remaining details, display will indicate their quantity.

Return to weighing

(see - 7.1.2. – return to weighing).

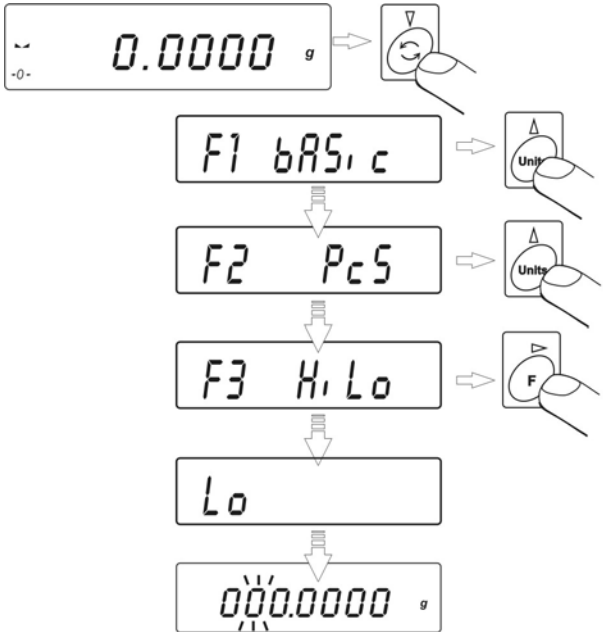


ATTENTION:

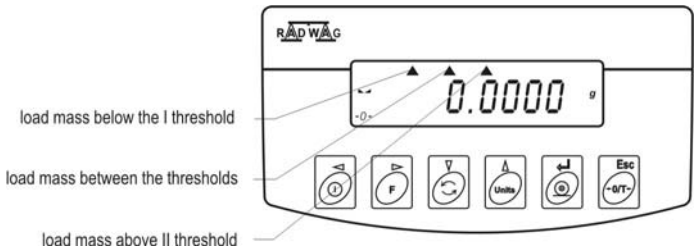
*If user presses **F** key when details are not placed on the pan, message **Er8 outr** will be indicated for few second and balance will automatically return to weighing.*

13.2. +/- control referring mass of set standard

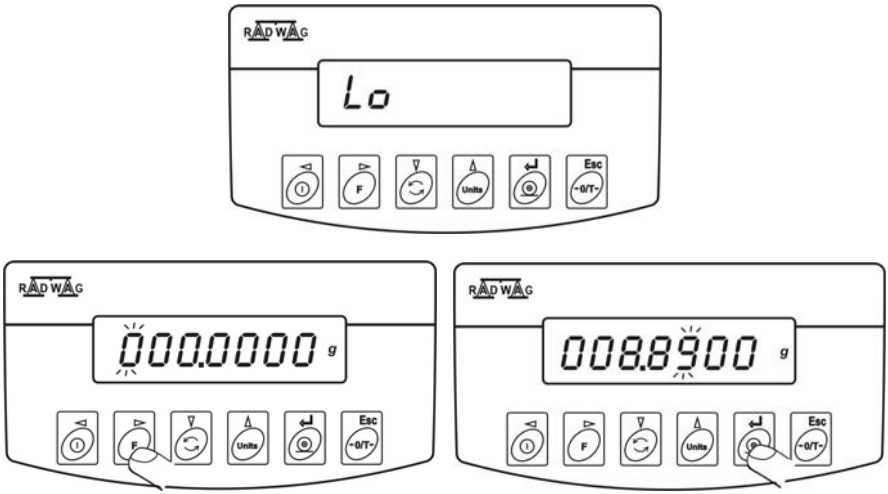
Procedure of operating:
Enter to function



During setting threshold values following dependences take place:

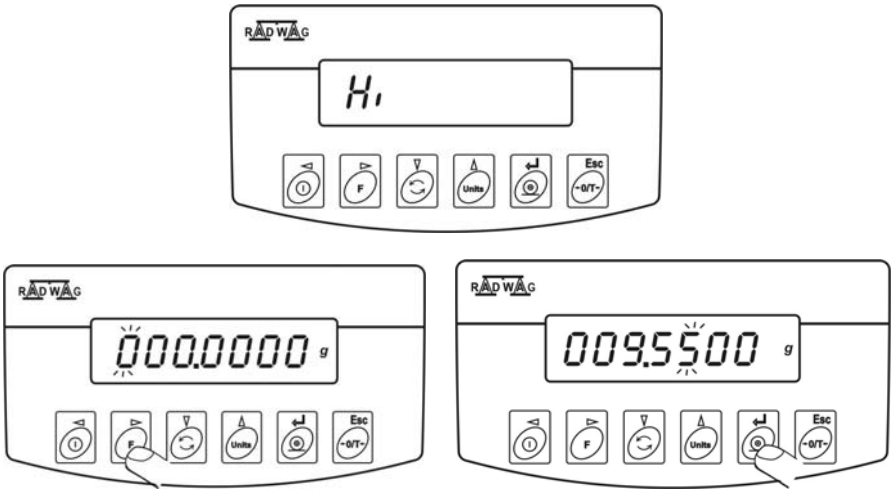


SET LOWER THRESHOLD

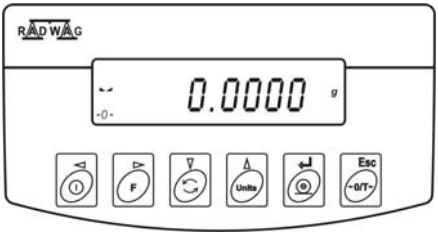


F – choice of set digit; **Units** - choice of value of digit; **PRINT** – confirmation of entered values

SET UPPER THRESHOLD



F – choice of set digit; **Units** - choice of value of digit; **PRINT** – confirmation of entered values.

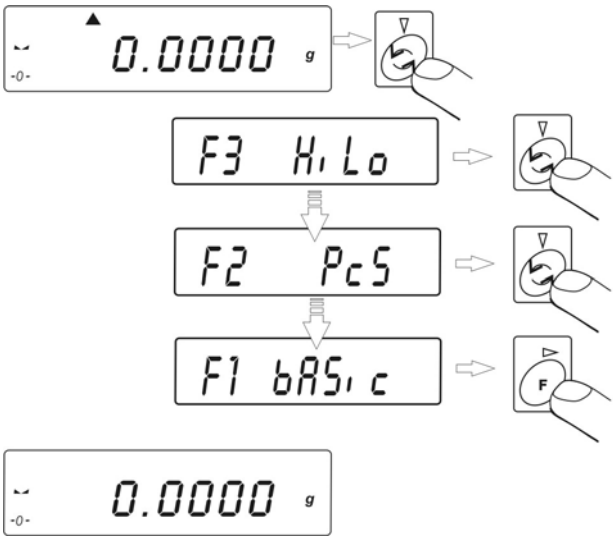


ATTENTION:

If user by mistake enters value of lower threshold higher than upper, balance will indicate error message and will return to weighing.

Return to weighing

(see - 7.1.2. – return to weighing).



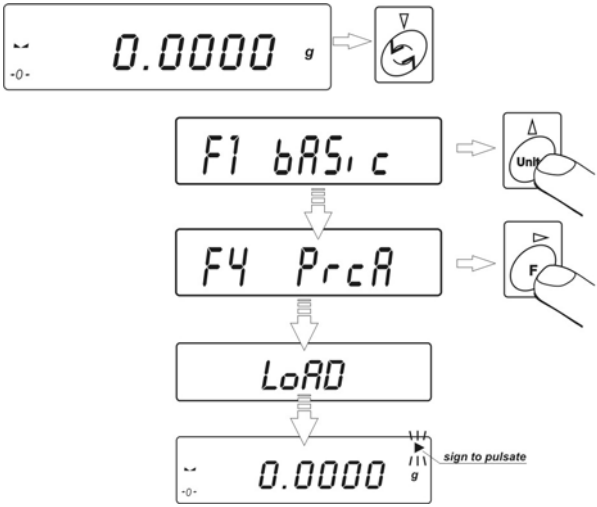
13.3. Control of % deviation referring mass of standard

Balance software enables control of deviation (in %) of weighed loads mass referring mass of standard. Mass of standard can be determined by its weighing (**PERC A** function) or entered to balance memory by user (**PERC B** function).

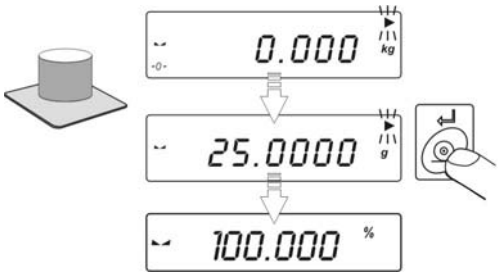
13.3.1. Mass of standard determined by its weighing

Procedure:

- Enter to function

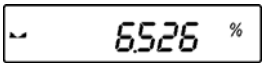


- place on the pan load which mass will be accepted as standard
- press **PRINT** to confirm this operating mode



- after few seconds indication **100,00%** will be displayed.

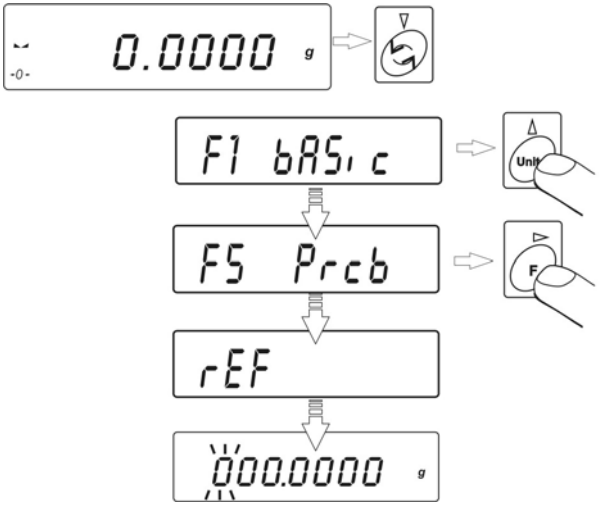
From this moment display will not indicate mass of weighed load but deviation of load mass placed on the pan referring mass of standard (in %).



13.3.2. Mass of standard entered to balance memory by user

Procedure:

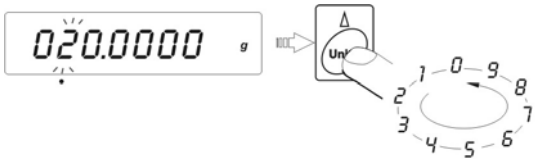
- Enter to function.



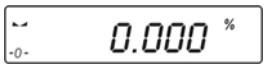
- Display will show indication as above
- Using keys

F – choice of set digit

Units - choice of digit value



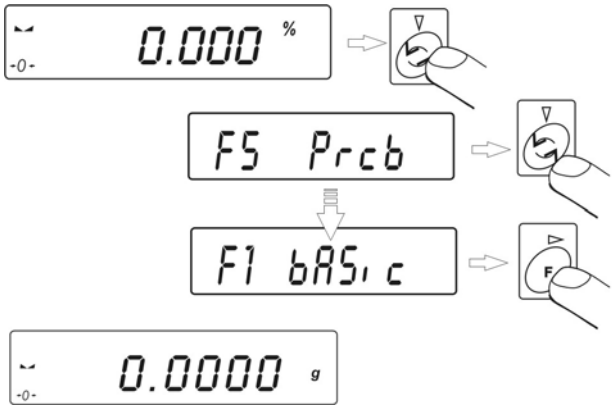
set **value of mass of standard**, enter it to balance memory using **PRINT** key – display will indicate: **0,00%**



From this moment display will not indicate mass of weighed load but deviation of load mass placed on the pan referring mass of standard (in %).

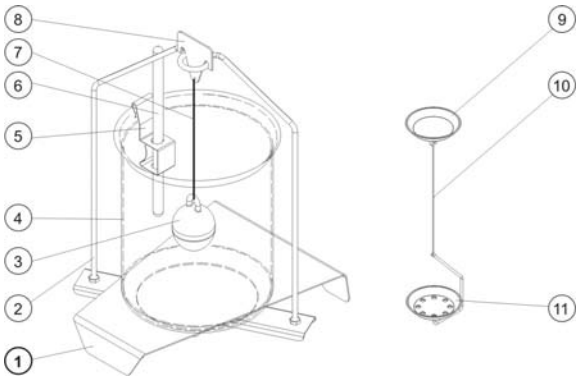
Return to weighing

(see - 7.1.2. – return to weighing).



13.4. Defining thickness of solids and liquids

There is equipment to defining thickness of solids and liquids in additional equipment. For user request RADWAG service can render special software to determine thickness by balance accessible.



1. beaker support
2. frame of balance
3. plunger
4. beaker
5. thermometer clench
6. thermometer

7. plunger string
8. plunger hanger
9. upper balance
10. balance string
11. down pan
12. additional loads for levelling initial load.

13.4.1. Testing thickness solids

Thickness of solids can be tested in one of 3 liquids:

- **H2O** (distilled water),
- **C2H5OH** (spirit 100% +/- 0.1% in temp. 20^0C),
- **AnotHEr** (another liquid with known thickness)

Give temperature of liquid for distilled water and spirit. For liquid with known thickness value is written on keyboard.

To test thickness weigh sample on upper pan and weigh the same sample in liquid (on lower pan). Result is represented on display automatically after replacing sample in liquid.

13.4.2. Testing thickness of liquid

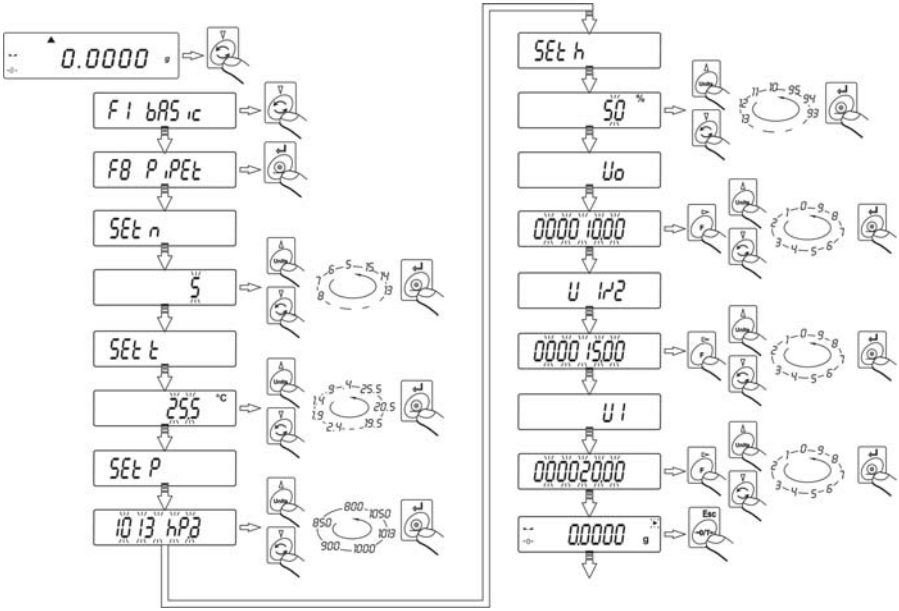
Basic element for measuring thickness of liquid is glass plunger. It has precise capacity shown on hook.
Before final measurements this value should be introduced to balance memory. To test thickness of liquid weigh glass plunger on upper pan and in tested liquid. Result of testing is shown on display automatically after introducing mass of plunger.

13.5. Pipettes calibration

Process of pipettes calibration is very simple and user friendly. It amounts to introduction of environmental data, parameters of calibration process and parameters of tested pipette.

13.5.1. Data introduction

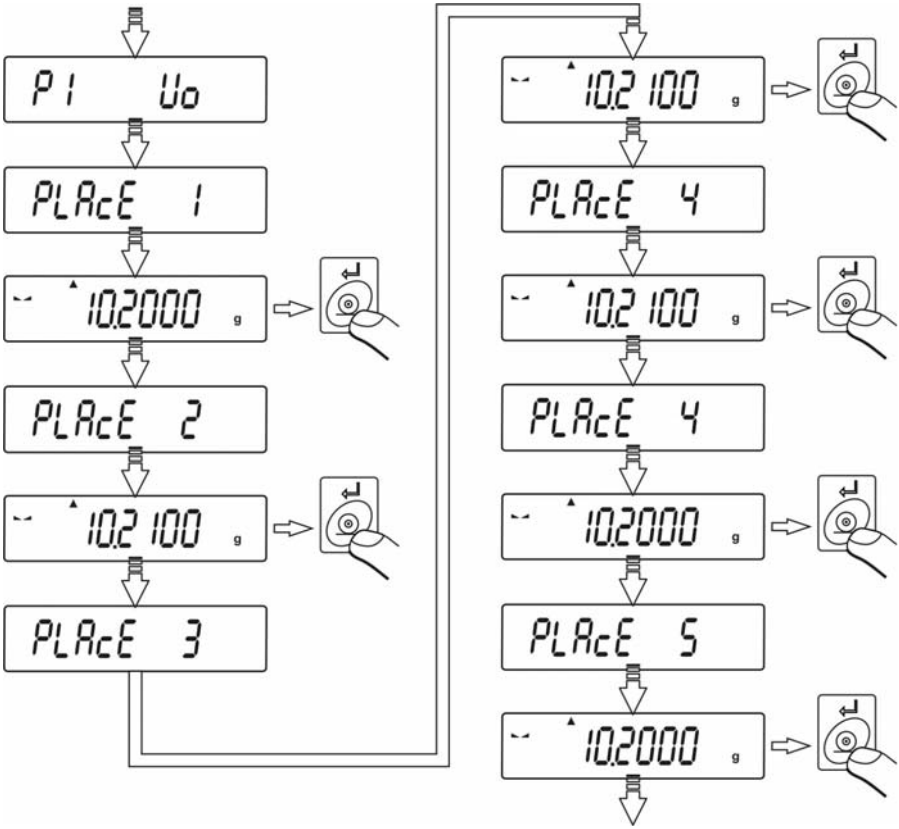
To start function of pipettes calibration and to introduce necessary calibration parameters, follow the instruction from the drawing:



- **Set n** – set quantity of repetitions performed during pipettes calibration (5 ÷ 15),
- **Set t** – set temperature for performing pipettes calibration (0,4 ÷ 25,5 °C),
- **Set P** – set pressure of room where pipettes calibration is performed (800 ÷ 1050 hPa),
- **Set h** – set humidity of room where pipettes calibration is performed (10 ÷ 95 %),
- **V_0** – initial volume of pipette (introduced by laboratory assistant),
- **$V_{1/2}$** – 50% of pipette volume (introduced by laboratory assistant),
- **V_1** – nominal volume of pipette (introduced by laboratory assistant).

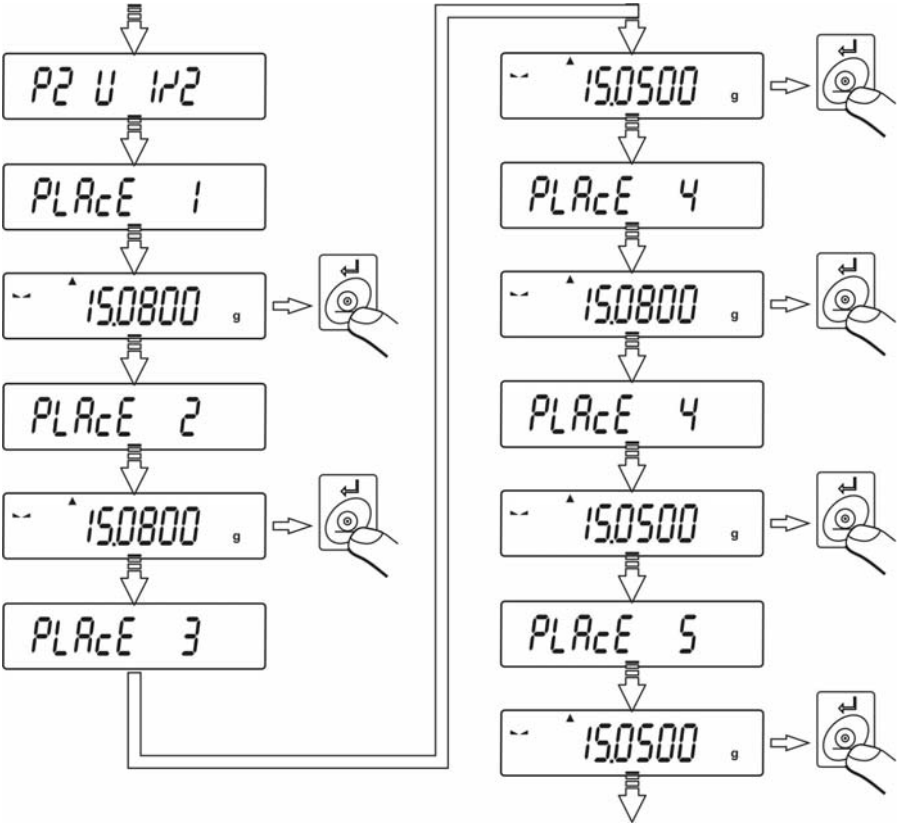
13.5.2. Performing first series of measurements

After introduction data necessary for pipettes calibration, press **ESC/TARA** key (when balance displays stability mark) – balance will start first series of measurements **P1 V_o**. Quantity of repetitions previously declared value of **Set n** parameter.



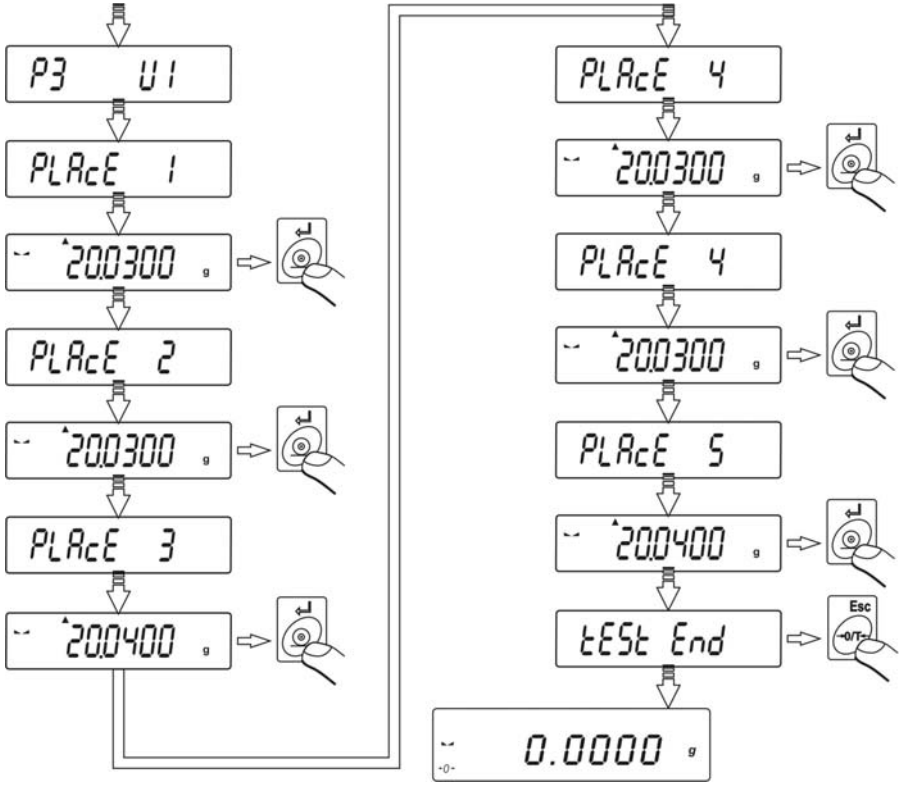
13.5.3. Performing second series of measurements

Second series of measurements is continuation of first series and procedure proceeds in the same way:

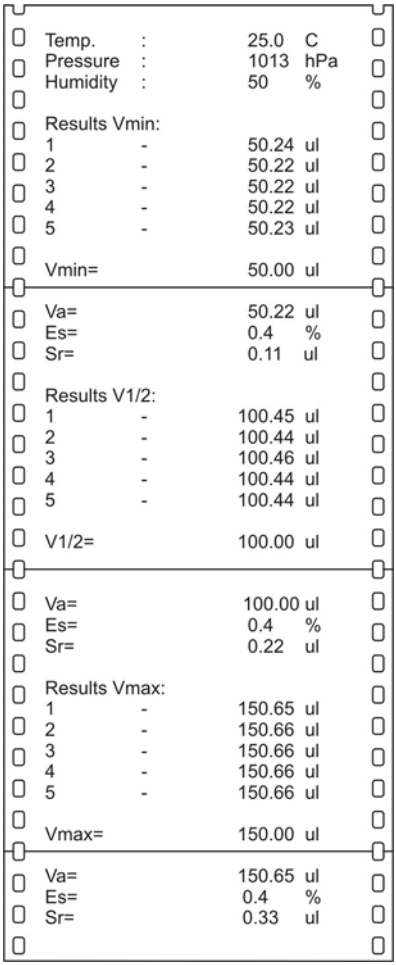


13.5.4. Performing third series of measurements

Third series of measurements is continuation of second series (procedure does not change). When third series is completed, message will be displayed about finish of calibration (**test End**), after which report from pipette calibration will be sent through RS 232 to computer or printer. To finish the process of pipettes calibration, press **ESC/TARA** key.



Exemplary printout from pipettes is show on the drawing below:



Temp.	:	25.0	C
Pressure	:	1013	hPa
Humidity	:	50	%
Results Vmin:			
1	-	50.24	ul
2	-	50.22	ul
3	-	50.22	ul
4	-	50.22	ul
5	-	50.23	ul
Vmin=		50.00	ul
Va=		50.22	ul
Es=		0.4	%
Sr=		0.11	ul
Results V1/2:			
1	-	100.45	ul
2	-	100.44	ul
3	-	100.46	ul
4	-	100.44	ul
5	-	100.44	ul
V1/2=		100.00	ul
Va=		100.00	ul
Es=		0.4	%
Sr=		0.22	ul
Results Vmax:			
1	-	150.65	ul
2	-	150.66	ul
3	-	150.66	ul
4	-	150.66	ul
5	-	150.66	ul
Vmax=		150.00	ul
Va=		150.65	ul
Es=		0.4	%
Sr=		0.33	ul

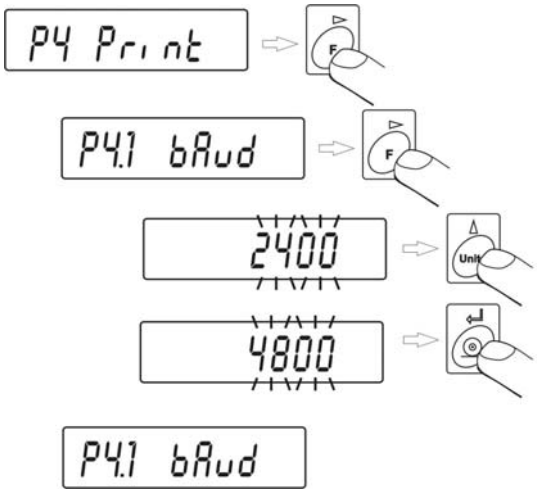
- **V_{min}, $V_{1/2}$, V_{max}** – respectively: initial volume, 50% of pipette volume and nominal pipette volume,
- **V_a** – arithmetic mean from measurement series,
- **E_s** – value of systematic error,
- **S_r** – value of repeatability standard deviation.

14. FUNCTIONS FOR USING RS 232

- Choose speed of transmission
- Define sent data as: stable / not stable
- Continuous work
- Setting data as additional element of parameter in printouts
- Turn on/off sign of last digit in printout
- automatic operating for RS 232.

14.1. Speed of transmission

Method of setting speed of transmission:



– choose required speed of transmission
- 2400 bit/s
- 4800 bit/s
- 9600 bit/s
- 19200 bit/s.

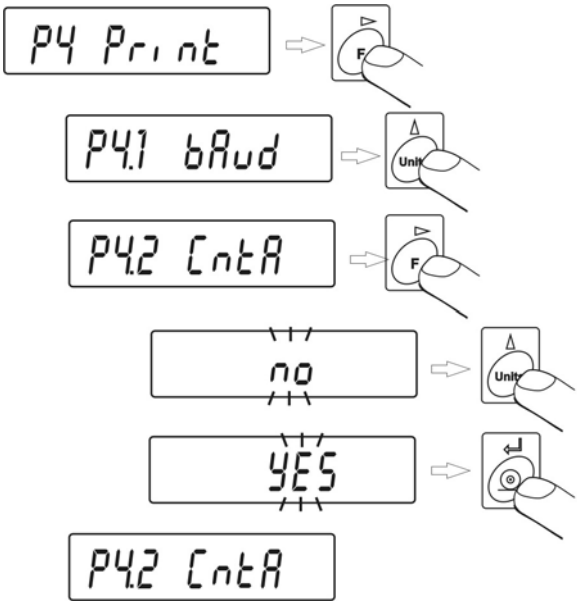
Return to weighing

(see - 7.1.2. – return to weighing).

14.2. Continuous transmission

14.2.1. Continuous transmission off in basic interval

Procedure:



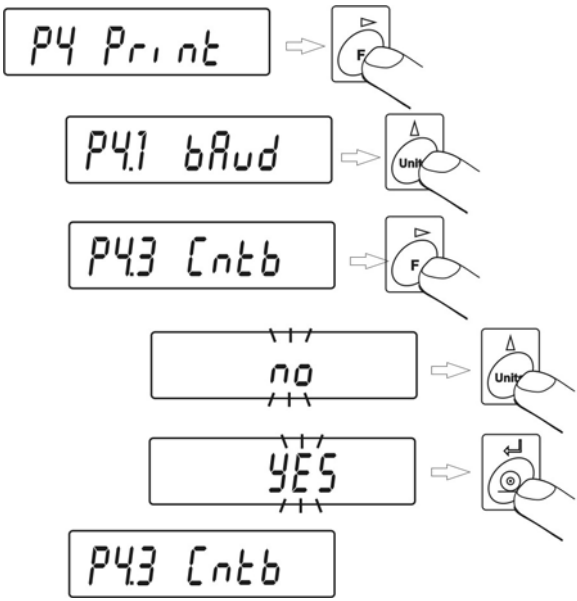
CntA **no** – continuous transmission off
CntA **YES** - continuous transmission on.

Return to weighing

(see - 7.1.2. – return to weighing).

14.2.2. Continuous transmission off in actual interval

Procedure:



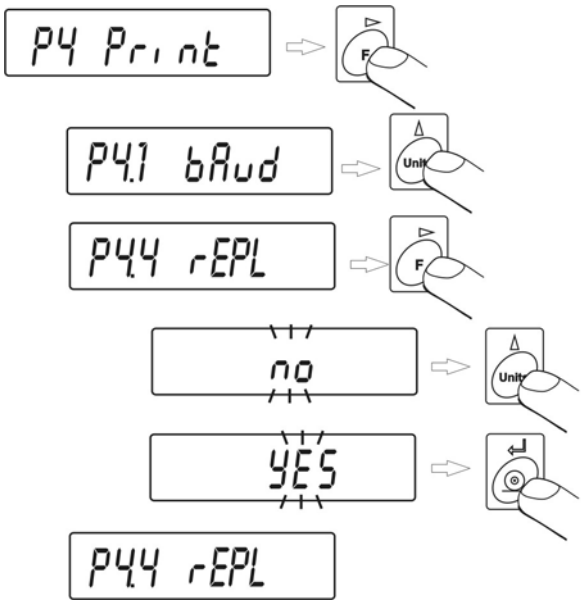
Cntb **no** – continuous transmission off
Cntb **YES** - continuous transmission on.

Return to weighing

(see - 7.1.2. – return to weighing).

14.3. Setting type of operating for RS 232 joint

Procedure:



rEPL **no** – **manual operating** / after pressing **PRINT** key

rEPL **YES** - automatic operating / after stabilization of weighing result.

Return to weighing

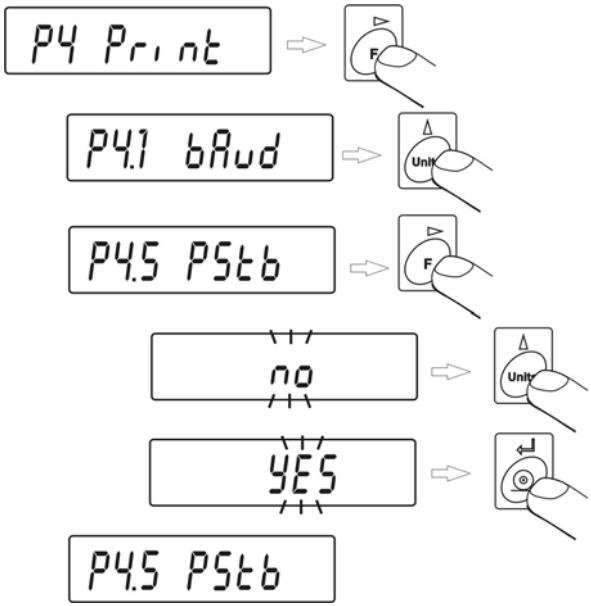
(see - 7.1.2. – return to weighing).

Automatic operating takes place according to following scheme:

- press TARE key to zero the balance (display will indicate marker of stable measurement and marker of zero)
- place the load, balance will send through the RS232 first stable measurement
- remove load from the pan,
- next measurement will be possible when weighing result +/- 50 reading units referring to zero (by next measurement zero stat is not required).

14.4. Designation of data type sent through RS 232 joint (only for non-verified balances)

Procedure:



PStb no – sending stable or temporary result of weighing
PStb YES – sending stable result of weighing.

Return to weighing

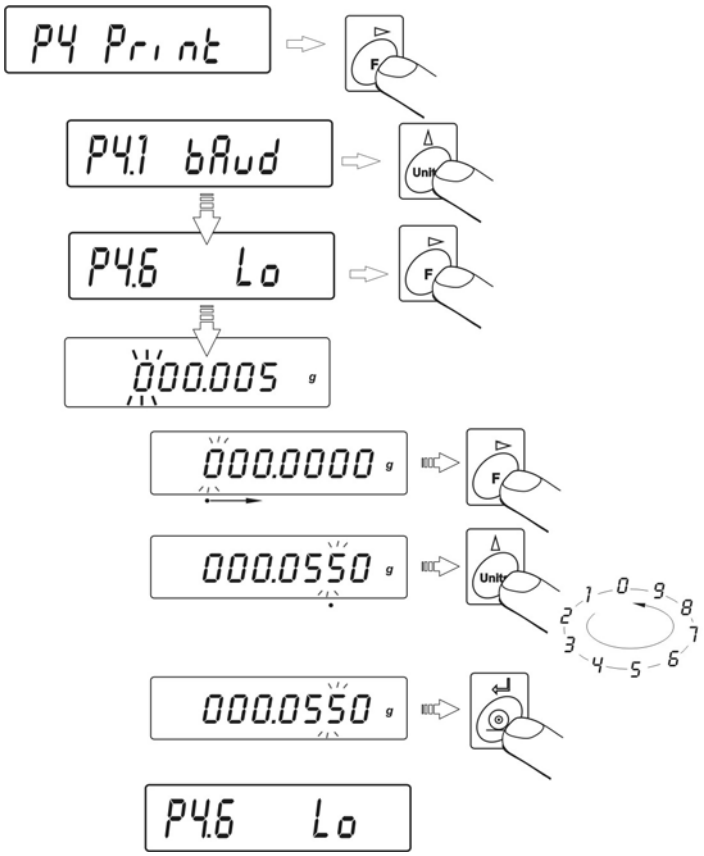
(see - 7.1.2. – return to weighing).

14.5. Designation of minimum mass for operating of some functions

Software enables setting operating of function **automatic operating**.

- for automatic operating result will not be sent to computer or printer until indication of mass goes below set **Lo** net value

Procedure:

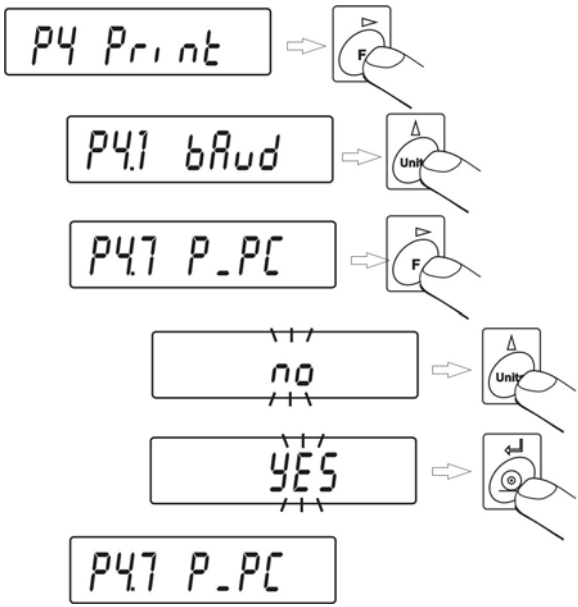


Return to weighing

(see - 7.1.2. – return to weighing).

14.6. Printout to printer or computer

Procedure:



P_PC **no** – printout to printer
P_PC **YES** – printout to computer.

Return to weighing

(see - 7.1.2. – return to weighing).

15. COOPERATION WITH PRINTER OR COMPUTER

Every pressing of key < **PRINT** > sends signal of current display state with measuring units to computer or printer. Balance has factory setting speed of transmission 4800 bit/s. If external mechanism (printer, computer) require digferent setting of speed of transmission, change factory setting on speed in menu (parameter **bod)**

Transmission parameters programmed in balance:

- Speed of transmission - 2400 – 19200 bit / s
- Data bits - 8
- Stop bit - 1
- Parity control - none.

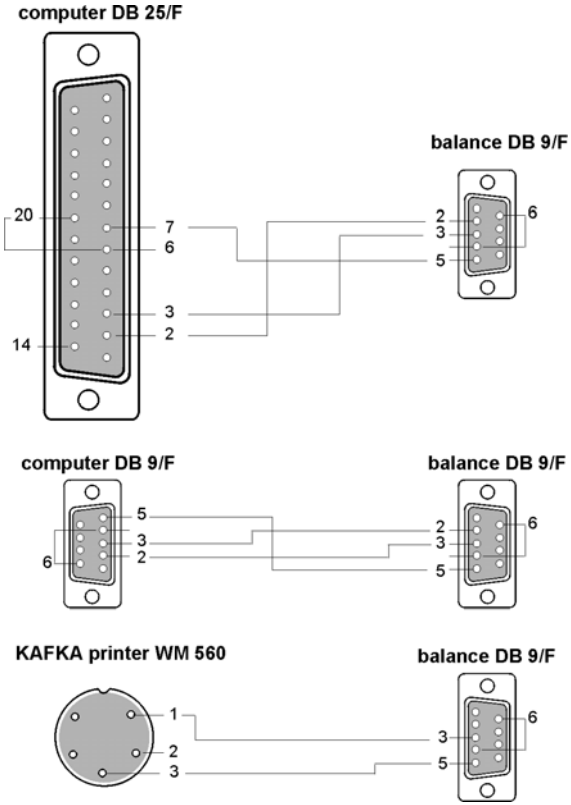
Sending weighing results to computer can take place:

- **manually** - after pressing **PRINT** key
- **continuously** – after function activating or sending steering commend
- **automatically** – when result is stable (if **REPL YES** and before placing weighed load balance indicated value below set Lo value)
- **on demand computer** – see List of messages

Value indicated by display can be sent through connection in series as:

- **stable** – start of sending the information will take place when weighing result is stable
- **unstable** – state of display is sent to external device when pressing **PRINT** key, and on printout such state is marked with <**?**> before weighing result.

15.1. Schedules of connecting conductors



WEIGHT	COMPUTER
2 (RxD)	3 (TxD)
3 (TxD)	2 (RxD)
4 (DTR)	6 (DSR)
5 (GND)	5 (GND)
6 (DSR)	6 (DTR)
7 (RTS)	8 (CTS)
8 (CTS)	7 (RTS)

15.2. Printing data with date and time

Every printout of weighing can be printed with date and time of measurement. It's possible if balance is connected to printer **Kafka 1/Z** or **Kafka SQ S**.

After connecting balance and printer set in balance menu parameters of **P2 GLP** group:

PdAt on value **YES**
Ptin on value **YES**

15.3. Cooperation with statistic printout Kafka SQS

After connecting balance to printer **KAFKA SQ S** statistic of measurement is possible to do. Example of printout with statistics from series of measurement:

1 9:02:15 + 7.0016 g
2 9:02:39 + 5.0152 g
3 9:02:58 + 12.0171 g
4 9:03:15 + 9.9937 g
5 9:03:34 + 12.0169 g
6 9:03:48 + 22.0111 g

Data 13.09.2001 Godz. 9:04

n	*6*		*batch quantity*
sum x	*68.0556*	*g*	*summary of mass of samples*
$\bar{x}$	*11.34260*	*g*	*average value*
s	*5.92328 g*	*standard deviation*	
srel	*52.22*	*%*	*factor of variancy*
min	*5.0152*	*g*	*min value*
max	*22.0111*	*g*	*max value*
R	*16.9959*	*g*	*difference max – min*

15.4. Format of sending data

Result of weighing can be sent from balance to external device after pressing the PRINT button on the balance or after sending order from the computer. Presented formats are conformable to settled parameter Pd_d = 1 (printout without last digit) for balances.

15.4.1. Format of sent data after pressing the PRINT button

Depending on setting of **P4.5 PStb** parameter only stable measurement or mass of instantaneous mass will be sent.

For verified balance printout of temporary measurements will be blocked for instantaneous measurements.

Format of printout

1	2	3	4 - 12	13	14 - 16	17	18
stability marker	space	mark	mass	space	unit	CR	LF

stability marker – [space] if stable
[?] if unstable
[^] if there is an error of exceeding the range on +
[v] if there is an error of exceeding the range on -
Mark – [space] for positive values or [-] for negative values
mass – 9 marks alignment to the right
units – 3 marks alignment to the left

15.4.2. Format of sent data for orders generated from the computer

Balance after receiving the command answers first:

XX_A CR LF – commend understood, realization started
XX_I CR LF – commend understood, but unavailable at the moment
XX _ ^ CR LF – commend understood, but max range is exceeded
XX _ v CR LF – commend understood, but min range is exceeded
XX _ E CR LF – error occurred while command realization – exceeded time limit while waiting for stable result (time limit is characteristic parameter of balance)
XX – name of command
And afterwards

1 - 3	4	5	6	7	8 - 16	17	18 - 20	21	22
Command	space	stability marker	space	mark	mass	space	unit	CR	LF

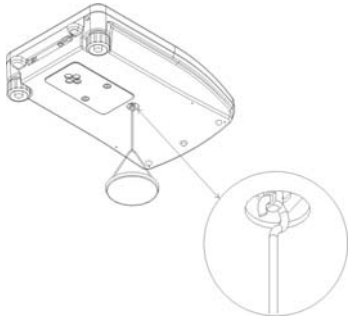
Command – 1 ÷ 3 marks
stability marker – [space] if stable
[?] if unstable
[^] if there is an error of exceeding the range on +
[v] if there is an error of exceeding the range on -
mark – [space] for positive values or [-] for negative values
mass – 9 marks alignment to the right
unit – 3 marks alignment to the left

16. WEIGHING LOADS UNDER BALANCE

In standard analytical and precision balances can weigh load on suspension.

To use this function:

- Remove plastic plug in basic of balance
- There is suspension in the basic of balance. It's installed for good.
- Install hook to hang load (hook isn't standard equipment for balance), weigh load on hook.



Attention:

- Suspension cannot be turned around, move or manipulate. Mechanism of balance can be damaged this way.
- Mass all additional elements as balance, string should be settled to zero by pressing key **Esc/TARE**.

17. LIST OF ORDERS IN RADWAG BALANCES

Function	**TARA**
Format	**T CR LF** (setting to tare)

Function	**ZERO**
Format	**Z CR LF** (setting to zero)

Function	**PRINT**
Format	**SI CR LF** (sending results when stab)

Function	**PRINT**
Format	**S CR LF** (sending results now)

Function	**CONSTANCE WORK** - equivalent for key conA on
Format	**C 1 CR LF** (start continuous transmission off in basic interval)

Function	**MANUAL WORK** - equivalent for order conA OFF
Format	**C 0 CR LF** (To change work mode on manual printout)

Function	**CONSTANCE WORK** - equivalent for key conb on
Format	**CU 1 CR LF** (start continuous transmission off in actual interval)

Function	**MANUAL WORK** - equivalent for order conb OFF
Format	**CU 0 CR LF** (To change work mode on manual printout)

Function	**SEND THE RESULT IN ACTUAL INTERVAL**
Command	**SU CR LF** (result in actual unit is sent from the balance after stability)

Function	**SEND RESULT IN ACTUAL INTERVAL IMMEDIATELY** (result in actual unit sending results now)
Command	**SUI CR LF**

If command which is not included in the register or is an error and ends with CR LF is sent to the balance the balance returns command E S CR LF.

18. ERROR MESSAGES

Er1 Hi - wrong initial mass or calibration

Er2 nuLL - values from A.D converter out of the normal range - under range

Er3 FuL1 - values from A.D converter out of the normal range - over range

Er4 FuL2 - over range

Er5 rout - value out of range for performed function e.g value > +/- 2% from initial mass for zeroing,

e.g. value <= 0 for tarring

Er7 tout - timeout error for zeroing and tarring

Er8 outr - enter value out of range

Er9 Lock - function locked e.g. to protect function if LFt (legal for trade) is on,

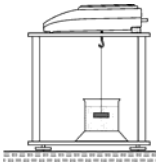
Er10 cal - calibration error (change of mass or incorrect mass of standard mass).

19. ADDITIONAL EQUIPMENT

19.1. Vibration damping table

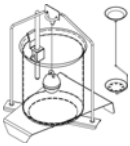
Thanks to this stable base all vibrations are eliminated.Inside of table marble plate is installed which makes foundation for balance.

19.2. Rack for weighing load under balance



It is used when weighing under balance is neccesary. It is usefull for magnetic load or when thickness of products is defined. Racks are used also during tests for absorptiveness of materials e.g. absorptiveness of foamed polystyrene. Structre of rack is made of steel. Rack is 330mm high.

19.3. Set for defining thickness of solids and liquids



It's appropriate for weighing with precision 1mg. It enables to define thickness solids and liquids. This procedure is fully automatically user only puts samples on weighing pans.

19.4. Additional display

Characteristics: Length of conductor between additional display and balance – 1,5m, plastic casing, possibility of bending the display.

19.5. Computer software

PW-WIN 2004 – gathering data from any balance made by RADWAG.
RAD-KEY 2000 – enables to introduce result of weighing to Exel.
REC-FS 2000 – making mixtures. It has its own programmed contents base according to recipes are made.

Number of instruction:
LMI-16-05/03/09/ENG

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